Original Article

Systematic review and meta-analysis of the related factors for diabetic retinopathy

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Background: The related factors of diabetic retinopathy (DR) had attracted the attention of many scholars, and a large number of articles had been published, but the research results were not consistent. A meta-analysis was conducted to synthesize recent evidence, aiming at exploring the relationship between DR and multiple risk factors.

Methods: The China National Knowledge Infrastructure, VIP, Wanfang, PubMed, Embase, Medline, and Cochrane databases were searched. The English and Chinese keywords included diabetes mellitus, DM, diabetic retinopathy, DR, and risk factors. In case-control study, the subjects are DR patients and NDR patients. In the cohort study, the subjects were diabetic patients. Measures in the intervention and control groups were described in detail. The methodological quality of the included literature was assessed using the Newcastle-Ottawa Scale (NOS). Egger's test is used to identify publication bias. With odds ratio (OR) as the effect index, heterogeneity test was conducted, and fixed effect model or random effect model was selected to calculate the combined OR and 95% CI.

Results: The meta-analysis included 12 literatures and 13 related risk factors, of which 4 (33.33%) were cohort studies and 8 (66.66%) were case-control studies. NOS shows that there are 7 references with 8 points (58.33%), 4 references with 7 points (33.33%) and 1 reference with 6 points (8.33%). The risk factors associated with the occurrence of DR were: course of diabetes (OR =1.03, 95% CI: 1.02–1.03), systolic blood pressure (OR =1.01, 95% CI: 1.01–1.02), body mass index (OR =0.96, 95% CI: 0.94–0.99), HbA1c (OR =1.08, 95% CI: 1.06–1.10), total cholesterol (OR =1.20, 95% CI: 0.98–1.46), high-density lipoprotein cholesterol (OR =1.74, 95% CI: 1.19–2.56), fasting blood glucose (OR =1.19, 95% CI: 1.13–1.26), and hypertension (OR =1.25, 95% CI: 1.07–1.47), and the overall effect test results were statistically significant. Sensitivity analysis results show that the random effect model is used for meta-analysis of all Meta, and the combined OR is 1.10, and the 95% CI is (1.05, 1.15).

Discussion: The occurrence of DR was related to the course of diabetes, SBP, HbA1c, total cholesterol, high-density lipoprotein cholesterol, fasting blood glucose, and hypertension which provided a more intuitive and comprehensive scientific basis for the prevention and treatment of DR.

Keywords: Diabetic retinopathy (DR); risk factors; meta-analysis

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Introduction

Diabetic retinopathy (DR) is one of the most common microvascular complications of diabetes (1-3). It can be divided into proliferative or non-proliferative DR depending on whether abnormal neovascularization from the retina is a criterion (4,5). Essentially, under the mechanism of hyperglycemia, retinal blood vessels, especially capillaries, develop corresponding lesions, and local retinal tissues cause neovascularization due to ischemia and hypoxia (6-8). DR patients see dark shadows floating in front of their eyes. The vitreous hemorrhage forms an organic membrane, and retinal detachment is pulled, so that patients' vision can decrease sharply or they can experience blindness. Patients with neovascular glaucoma may experience redness, eye swelling, eye pain, headache, nausea, vomiting, etc. A loss of vision leads to a decline in patients' quality of life; thus, effective prevention and treatment methods are urgently needed (9-11). Extensive researches of DR are not yet clear and no complete cure has been found. Thus, the risk factors urgently need to be explored to delay the occurrence and development of DR and find a new and effective treatment for DR.

The pathogenesis of DR is complex, and is related to a variety of risk factors, such as sex (i.e., being male), the course of diabetes, glycosylated hemoglobin, urine microalbumin, body mass index (BMI), hypertension, and total cholesterol (TC) (12,13). The longer the history of diabetes, the higher a patient's blood sugar, and the higher a patient's blood pressure, the more DR. However, different studies have drawn inconsistent conclusions about the individual risk factors for DR. For example, Alattas *et al.* [2022] (14) showed that HbA1c was not associated with the occurrence of DR; however, Tapp *et al.* [2003] (15) suggested that HbA1c was one of the risk factors for Dr. Zheng *et al.* [2011] (16) showed that female was a risk factor for DR, while Yan *et al.* [2016] (17) pointed out that female was not a risk factor for DR. The reasons for these differences in results may be related to inconsistencies in the research methods, population-based characteristics, and the geographic regions examined in the studies.

To obtain a large amount of the latest evidence and analyze the risk factors for DR more intuitively and reliably, we conducted a meta-analysis to explore the correlations between DR and multiple risk factors. Several meta-analyses on DR risk factors have been conducted; however, these meta-analyses did not take race into consideration. Further, the risk factors for DR have not been comprehensively analyzed. Thus, general characteristics and laboratory tests were examined as DR risk factors in our systematic evaluation and meta-analysis. Our final quantitative results provide a scientific evidence-based foundation for the clinical treatment of DR. We present the following article in accordance with the MOOSE reporting checklist (available at https://apm.amegroups.com/article/view/10.21037/apm-22-437/rc).

Methods

Articles screening

Before the search, we read a large number of documents on the subject of this study, conducted a preliminary search of the electronic databases, and determined the search strategy and search terms. The China National Knowledge Infrastructure database, VIP, Wanfang, PubMed, Embase, Medline, and Cochrane database were the searched to find case-control studies and cohort studies published from the establishment of the databases to September 15, 2021. The subject words and free words were combined in multiple searches that were conducted to retrieve references that could be included in our meta-analysis. The English search keywords included diabetes mellitus, DM, diabetic retinopathy, DR, and risk factors, while the Chinese search keywords included diabetes mellitus, DM, diabetic retinopathy, DR, and risk factors. Next, a search engine was used to track each article, obtain the latest research progress, and find more relevant articles for inclusion in the meta-analysis.

Inclusion and exclusion criteria

PICOS principle is adopted to help complete the research design. P (research object): in case-control study, the research objects are DR patients and NDR patients; in the cohort study, the subjects were diabetic patients. Literature provides data of DR and its 95% CI of DR-related risk factors; Define intervention measures and control measures. O (research results): the main endpoint index with core significance for clinical efficacy evaluation, such as systolic blood pressure (SBP), diastolic blood pressure (DBP), and body mass index (BMI). S (study design): the included literature is a cohort or case-control study.

Articles were excluded from the meta-analysis if they met any of the following exclusion criteria: (I) comprised an individual case study, review, or non-research article;

(II) comprised non-observational research; (III) had been published repeatedly, had unavailable data or information, or did not include the original data; and/or (IV) failed to mention data about the related risk factors.

Types and classifications of risk factors

Age, sex, course of diabetes, systolic blood pressure (SBP), diastolic blood pressure (DBP), body-mass index (BMI), hypertension, fasting blood glucose (FBG), glycosylated hemoglobin (HbA1c), total cholesterol (TC), total triglyceride (TG), highly sensitive C-reactive protein (hsCRP), low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C).

Data screening of risk factors

In this study, two evaluators used uniform standards to conceal the authors, institutions, journals, and project funding of the included articles, and independently extract the paper data to screen multivariate logistic regression data. Articles that did not examine the risk factors for DR in diabetic patients were excluded from the meta-analysis.

The main data extracted were as follows: (I) basic information about each included article (e.g., the title, country, name of the first author, journal, publication period, and region); (II) the characteristics of the research subjects (i.e., gender, age, and number of cases); and (III) data related to risk factors [e.g., the odds ratio (OR) values, and 95% CIs].

Quality assessment methods

The two reviewers simultaneously evaluated the risks of bias for the included articles, and any differences in opinion were resolved through discussion. In this paper, Newcastle-Ottawa Scale (NOS) is used to evaluate the methodological quality of the included literature. The score of NOS scale is 0–9, including 3 parts and 8 points: selection (4 points), comparability (2 points), and outcome (2 points) (18). You can get up to one star in the selection and exposure of a study, and up to two stars in the comparability. 0–3 points are considered as low quality, 4–6 points as medium quality and 7–9 points as high quality.

Statistical methods

Stata SE 12.0 software (College Station, USA) was used for the statistical analysis. The OR (odds ratio) were used as the evaluation index. Each effect was expressed using a 95% CI. Chi-square-based Q-test is used to evaluate the heterogeneity among literatures. If $P>0.1$ and $I^2<50\%$, the heterogeneity was considered low, and a fixed-effects model (FEM) was used for the meta-analysis. If $P<0.1$ and $I^2>50\%$, the heterogeneity was considered high heterogeneity, and a random-effects model (REM) was used for the meta-analysis. Multivariate Logistic regression was carried out on the variables with statistical significance in univariate analysis, and the relationship between the research factors of each binary variable and DR was analyzed. If $P\leq0.05$, the combined statistics of multiple studies were statistically significant; if $P>0.05$, the combined statistics of multiple studies were not statistically significant.

Sensitivity analysis

Sensitivity analysis is to check the stability of the results obtained under certain assumptions. Objective to find out the main factors that influence the results of Meta-analysis, solve the contradiction of different research results, and find out the reasons for different conclusions. The commonly used methods are: (I) the sample size, comparing the meta-analysis results of all selected literatures Meta those excluding small samples; (II) different statistical methods, when there is no significant heterogeneity in each research result, compare the results of fixed effect model and random effect model.

Results

Search results and basic document information

Our search of the databases led to the retrieval of 4,128 articles. We removed 1,035 articles that had been the subject of repeat publications, 892 articles that were excluded, and 1,112 articles for other reasons, after which 1,089 articles remained. After the full texts of the articles were read for screening, 452 additional articles were removed. A total of 527 articles were removed due to issues related to the research subjects, 35 articles were removed as they were reviews, and 63 articles were removed as they contained incomplete data. Ultimately, 12 articles, examining 13 risk factors, were included in the meta-analysis. To address the lack of universality or the sensitivity of the results, the potential risk factors for DR were excluded if there were ≤ to 2 of the same risk factors. *Figure 1* shows a flowchart of

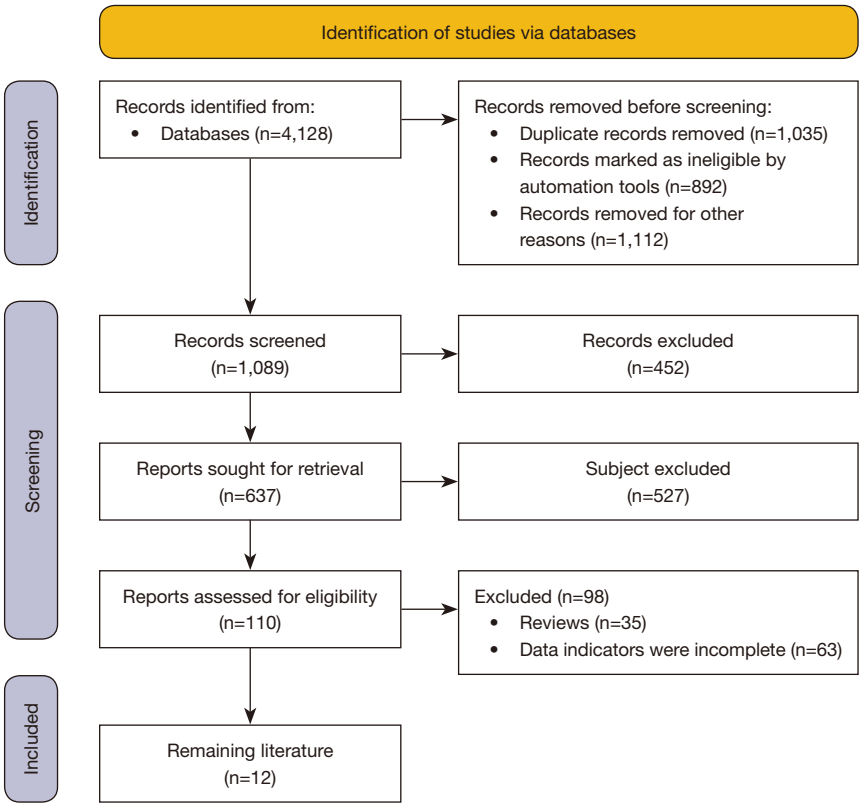

Figure 1 Flow chart for literature screening.

the process used to search and screen the articles.

Table 1 sets out the basic information of the articles and the risk factors for DR. According to the geographical statistics of the first author, 1 article was published in Beijing, 1 article was published in Harbin, 2 articles were published in Chongqing, 1 article was published in Shandong, and 1 article was published in Hong Kong.

Results of the publication bias of the included articles

Among the 12 articles included, 4 (33.33%) were cohort studies, and 8 (66.66%) were case-control studies. The score of NOS scale shows that there are 7 references with 8 points (58.33%), 4 references with 7 points (33.33%) and 1 reference with 6 points (8.33%). The publication bias of the articles included in this paper is tested by egger, as shown in *Figure 2*. The test results show that P=0.406>0.05, which indicates that the research included in this paper has no significant publication bias.

Meta-analysis results of age and sex as risk factors

There are 4 literatures on the influence of age on DR. Meta-analysis shows that there is no heterogeneity among the literatures with age [Chi^2 =0.73, d.f. (degree of freedom) =3, I^2=0.0%, P=0.866]. The fixed effect model was used for analysis, and the combined OR was 0.97, 95% CI (confidence interval) was (0.96, 0.98). The overall effect test showed that Z=5.70, P=0.000, which was no statistically significant, as shown in *Figure 3*.

There are 3 literatures on the influence of gender on DR, and the meta-analysis shows that there is no heterogeneity among the literatures Meta gender (Chi^2 =1.37, d.f. =2, I^2=0.0%, P=0.504). The fixed effect model was used for analysis, and the combined OR was 1.09, 95% CI was (0.85, 1.41). The overall effect test, Z=0.68, P=0.496, had no statistical significance, as shown in *Figure 4*.

Meta-analysis results of course of disease as a risk factor

There are 9 literatures about the influence of disease course

Table 1 The basic information of the articles exploring the risk factors for DR

The first author	Year of publication	Area	Diagnostic criteria for DM	Cases of patients		Risk factors
				Experimental group	Control group	
Ding (19)	2018	Chongqing	WHO	159	122	Age, sex, course of diabetes, SBP, DBP HbA1c, BMI, hsCRP, TC, TG, HDL-C, and LDL-C
Liu (20)	2016	Harbin	WHO	93	251	Age, sex, course of diabetes, hypertension, HbA1c, BMI, hsCRP, FBG, TG, TC, HDL-C, LDL-C, and HOMA-IR
Man (21)	2015	Shandong	American Diabetes Associations	184	189	Age, sex, course of diabetes, BMI, HbA1c, FBG, TG, TC, hsCRP, SBP,DBP , HDL-C, LDL-C, and HOMA-IR
Tam (22)	2009	Hong Kong	–	212	91	Age, sex, course of diabetes, BMI, HbA1c, TC, TG, hsCRP, HDL-C, and LDL-C
Tang (23)	2018	Chongqing	WHO	301	1,120	Age, sex, course of diabetes, BMI, FBG, HbA1c, TG, TC, hsCRP, SBP, and DBP
Xu (24)	2012	Beijing	WHO	496	1,511	Age, sex, course of diabetes, hypertension, SBP, DBP, BMI, HbA1c, TC, TG, HDL-C, and LDL-C
Yin (25)	2020	Shijiazhuang	WHO	409	599	Age, sex, course of diabetes, HbA1c, SBP, DBP, BMI, FBG, TC, TG, HDL-C, LDL-C
Yue (26)	2015	Shenyang	WHO	125	63	Age, sex, course of diabetes, HbA1c, SBP, DBP, BMI, FBG, TC, TG, HDL-C, and LDL-C
Zhang (27)	2009	Hubei	American Diabetes Association	166	340	Age, sex, course of diabetes, HbA1c, SBP, DBP, BMI, TC, TG, and HOMA-IR
Zhao (28)	2017	Liaoning	American Diabetes Association	79	202	Age, sex, course of diabetes, HbA1c, SBP, DBP, BMI, FBG, TC, TG, HDL-C, LDL-C, hsCRP, HOMA-IR, and eGFR
Zhong (29)	2015	Anhui	WHO	94	110	Age, sex, course of diabetes, SBP, DBP, BMI, HbA1c, TC, TG, HDL-C, and LDL-C
Martín-Merino (30)	2016	UK	–	7,735	9,395	Age, sex, course of diabetes, BMI, SBP, DBP, TC, LDL, HDL

DR, diabetic retinopathy; WHO, World Health Organization; SBP, systolic blood pressure; DBP, diastolic blood pressure; BMI, body mass index; FBG, fasting blood glucose; HbA1c, glycosylated hemoglobin; TC, total cholesterol; TG, total triglyceride; hsCRP, high sensitivity C-reactive protein; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; HOMA-IR, homeostatic measurement assessment-insulin resistance; eGFR, estimated glomerular filtration rate.

on DR. Meta-analysis shows that there is heterogeneity among the literatures included in disease course (Chi^2 =123.55, d.f. =8, I^2=93.5%, P=0.000). The random effect model is used for analysis, and the combined OR is 1.03, and the 95% CI is (1.02, 1.03). The overall effect test, Z=9.44, P=0.000<0.001, has statistical significance, as shown in *Figure 5*.

Meta-analysis results of systolic and diastolic blood pressure as risk factors

There are 6 literatures on the influence of systolic blood pressure on DR, and the meta-analysis shows that there is heterogeneity among the literatures (Chi^2 =27.64, d.f. =5, I^2=81.9%, P=0.000). The random effect model is used for

Egger's test for small-study effects:
Regress standard normal deviate of intervention effect estimate against its standard error

•

Number of studies =5 Root MSE =0.4815

Std Eff	Coef.	Std. Err.	*t*	P>|*t*|	[95% Conf.	Interval]
Slope	−0.0343079	0.0044714	−7.67	0.005	−0.0485377	−0.020078
Bias	0.3726848	0.3861617	0.97	0.406	−0.8562542	1.601624

Test of HO: no small-study effects P=0.406

Figure 2 Egger's test results. MSE, mean square error.

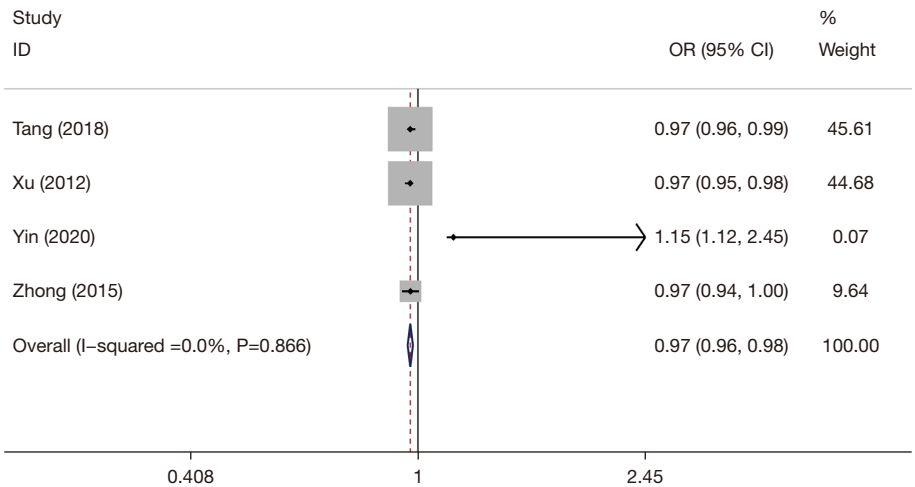

Figure 3 Forest map as a risk factor of age.

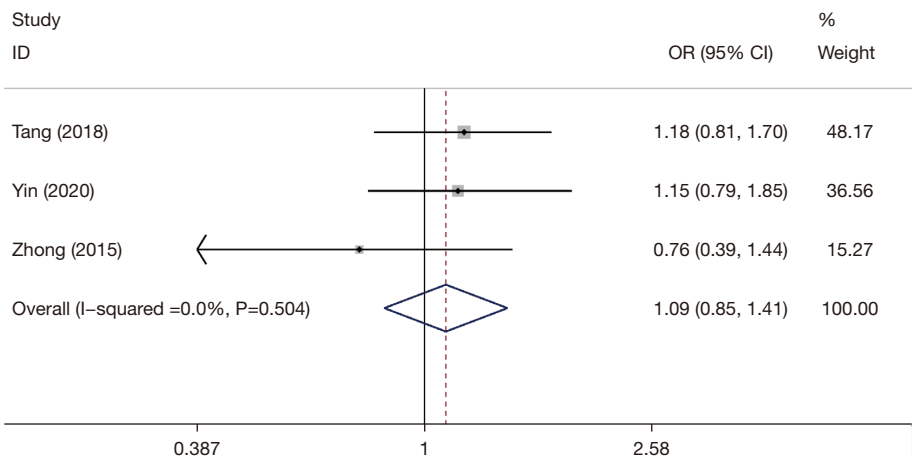

Figure 4 Forest map with gender as a risk factor.

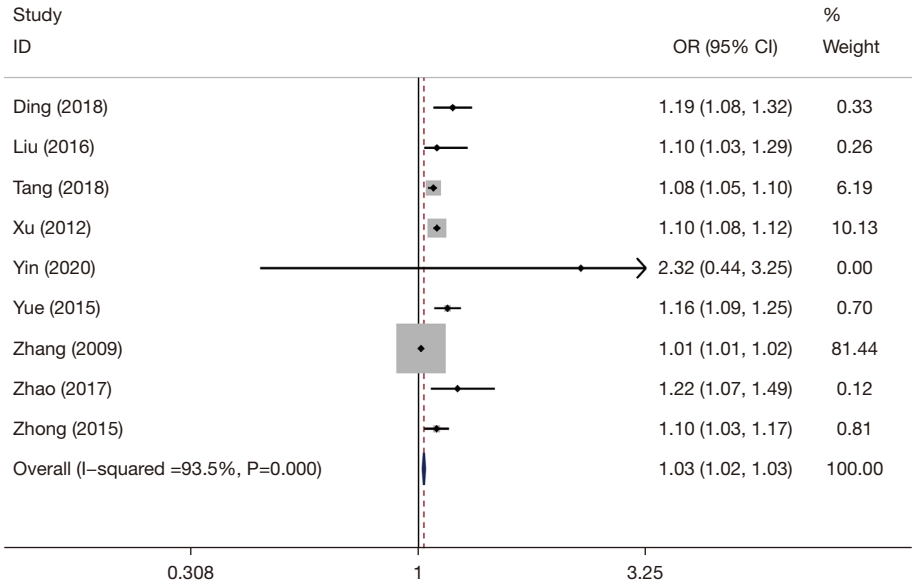

Figure 5 Forest plot of disease duration as a risk factor.

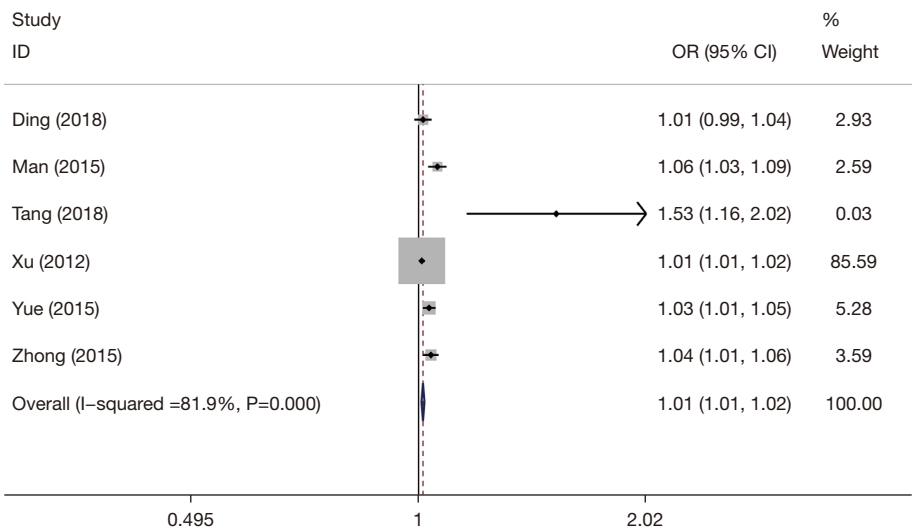

Figure 6 Forest plot of systolic blood pressure as a risk factor.

analysis, and the combined OR is 1.01, and the 95% CI is (1.01, 1.02). The overall effect test, Z=5.86, P=0.000<0.001, has statistical significance, as shown in *Figure 6*.

Meta-analysis of BMI as a risk factor

There are 4 literatures on the influence of BMI on DR. Meta-analysis shows that there is heterogeneity among the literatures with BMI (Chi^2 =9.06, d.f. =3, I^2=66.9%, P=0.028). The random effect model is used for analysis, and the combined OR is 0.96, 95% CI is (0.94, 0.99). The overall effect test, Z=2.54, P=0.011, has statistical significance, as shown in *Figure 7*.

Meta-analysis results of HbA1c as a risk factor

There are 8 literatures on the influence of HbA1c on DR, and the meta-analysis results show that there is

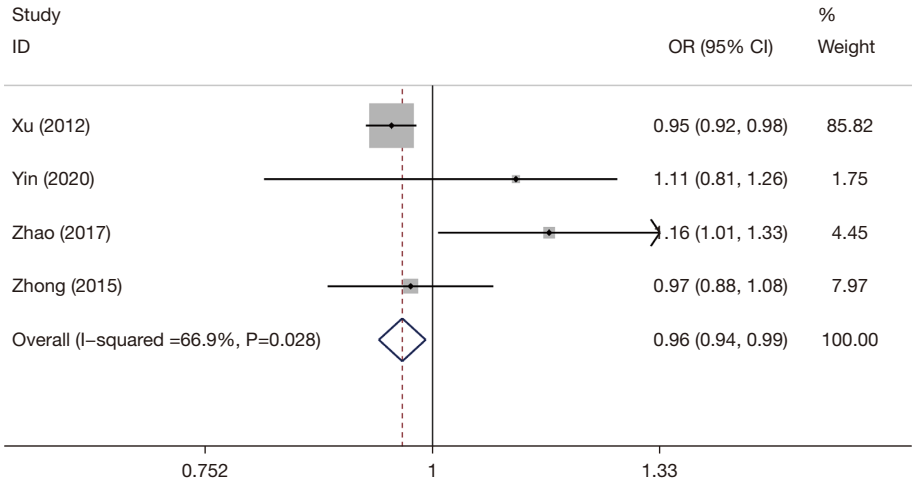

Figure 7 Forest map with BMI as a risk factor. BMI, body mass index.

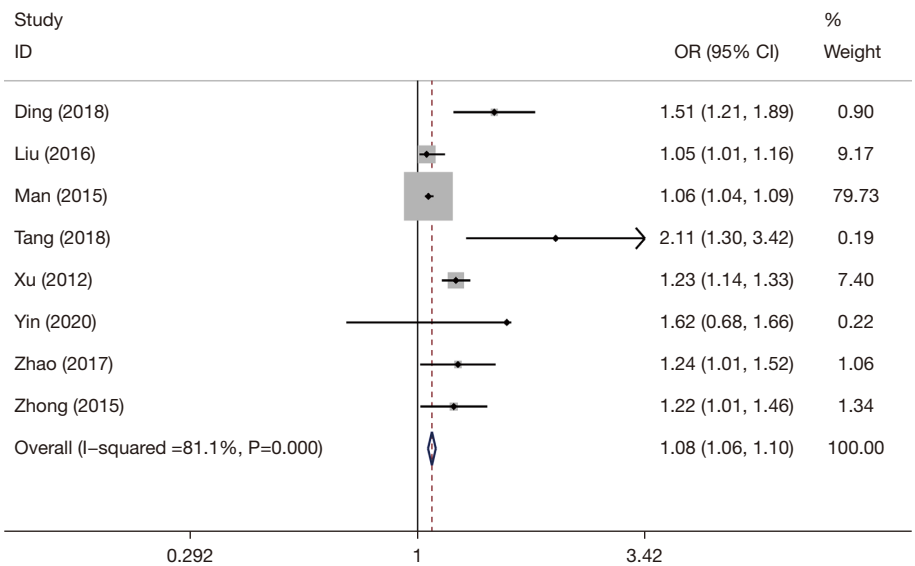

Figure 8 Forest map of HbA1c as a risk factor. HbA1c, glycosylated hemoglobin.

heterogeneity among the literatures included in HbA1c (Chi^2 =37.01, d.f. =7, I^2=81.1%, P=0.000). The random effect model was used for analysis, and the combined OR was 1.08, and the 95% CI was (1.06, 1.10). The overall effect test, Z=7.23, P=0.000<0.001, had statistical significance, as shown in *Figure 8*.

Meta-analysis of total cholesterol as a risk factor

There are 4 literatures on the influence of total cholesterol on DR, and the meta-analysis results show that there is heterogeneity among the literatures on total cholesterol (Chi^2 =8.24, d.f. =3, I^2=63.6%, P=0.041). The random effect model is used for analysis, and the combined OR is 1.20, 95% CI is (0.98, 1.46). The overall effect test, Z=1.75, P=0.081, has statistical significance, as shown in *Figure 9*.

Meta-analysis of triglyceride as a risk factor

There are 4 literatures on the influence of triglyceride on DR, and the meta-analysis results show that there is heterogeneity among the literatures (Chi^2 =9.28, d.f. =3,

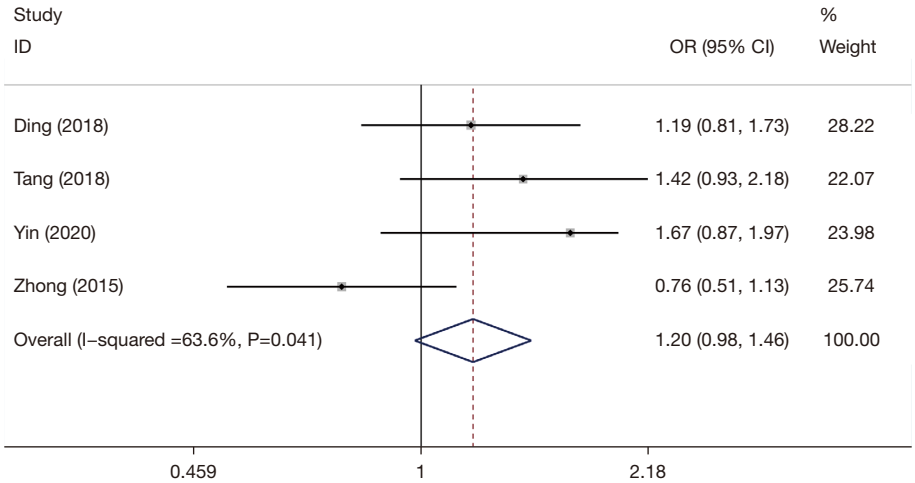

Figure 9 Forest map of total cholesterol as a risk factor.

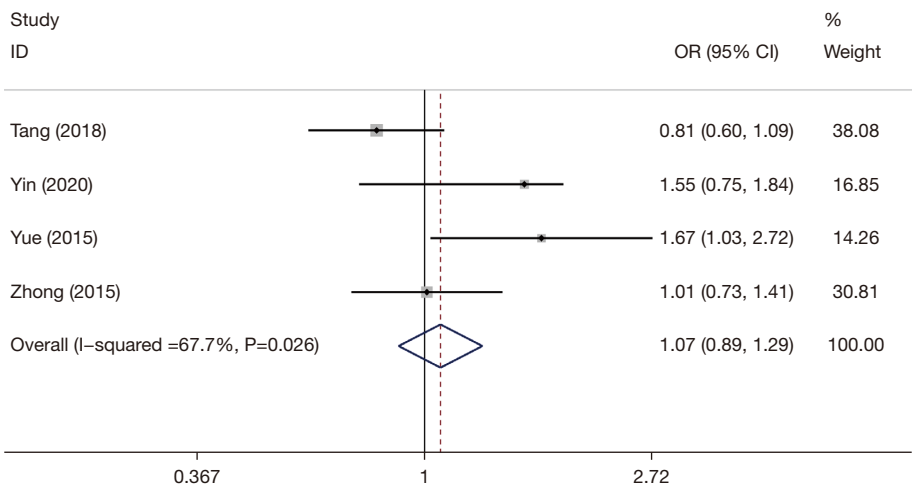

Figure 10 Forest map of triglyceride as a risk factor.

I^2=67.7%, P=0.026). The random effect model was used for analysis, and the combined OR was 1.07, and the 95% CI was (0.89, 1.29). The overall effect test, Z=0.74, P=0.457, had statistical significance, as shown in *Figure 10*.

Meta-analysis of high density lipoprotein cholesterol as a risk factor

There are 3 literatures on the influence of high-density lipoprotein cholesterol on DR, and the meta-analysis results show that there is heterogeneity among the literatures Meta high-density lipoprotein cholesterol (Chi^2 =12.22, d.f. =2, I^2=83.6%, P=0.002). The random effect model is used for analysis, and the combined OR is 1.74, 95% CI is (1.19, 2.56). The overall effect test, Z=2.84, P=0.005, has statistical significance, as shown in *Figure 11*.

Meta-analysis of low density lipoprotein cholesterol as a risk factor

There are 3 literatures on the influence of low-density lipoprotein cholesterol on DR, and the meta-analysis results show that there is heterogeneity among the literatures Meta low-density lipoprotein cholesterol (Chi^2 =5.76, d.f. =2, I^2=65.3%, P=0.056). The random effect model is used for analysis, and the combined OR is 0.91, 95% CI is (0.71,

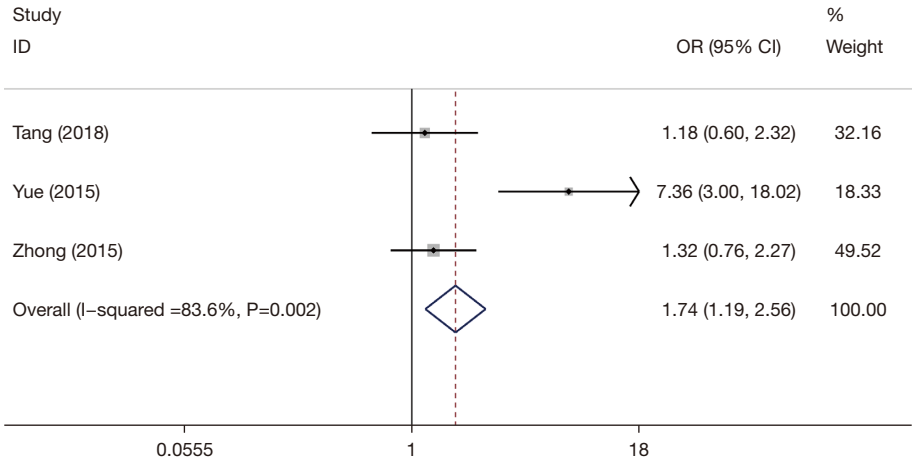

Figure 11 Forest map of high density lipoprotein cholesterol as a risk factor.

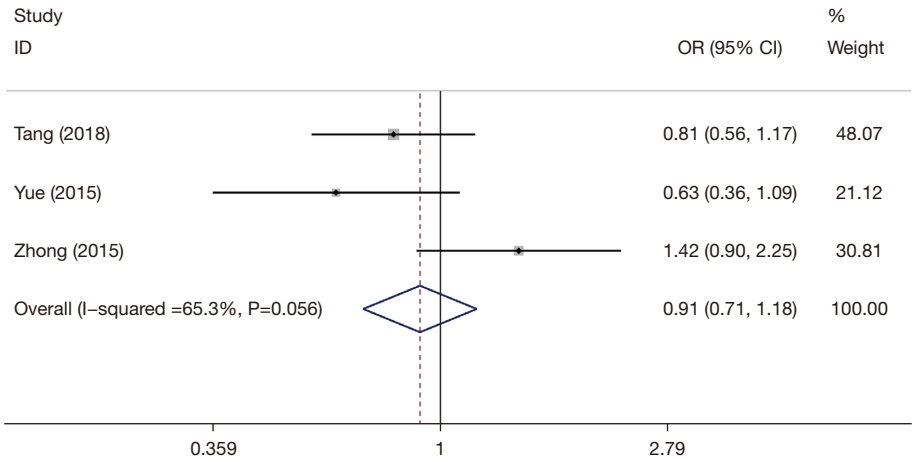

Figure 12 Forest map of low density lipoprotein cholesterol as a risk factor.

1.18). The overall effect test, Z=0.70, P=0.481, had no statistical significance, as shown in *Figure 12*.

Meta-analysis results of sensitive C-reactive protein as a risk factor

There are 3 literatures about the influence of high-sensitivity C-reactive protein on DR, and the meta-analysis shows that there is heterogeneity among the literatures Meta high-sensitivity C-reactive protein (Chi^2 =3.99, d.f. =2, I^2=49.9%, P=0.136). The random effect model is used for analysis, and the combined OR is 1.10, 95% CI is (1.04, 1.17). The overall effect test, Z=3.25, P=0.001, has no statistical significance, as shown in *Figure 13*.

Meta-analysis of fasting blood glucose as a risk factor

There are 3 literatures on the influence of fasting blood glucose on DR, and the meta-analysis shows that there is heterogeneity among the literatures (Chi^2 =6.40, d.f. =2, I^2=68.8%, P=0.041). The random effect model is used for analysis, and the combined OR is 1.19, 95% CI is (1.13, 1.26). The overall effect test, Z=6.03, P=0.000<0.0001, has statistical significance, as shown in *Figure 14*.

Meta-analysis of hypertension as a risk factor

There are 2 literatures on the influence of hypertension on DR. Meta-analysis shows that there is no heterogeneity

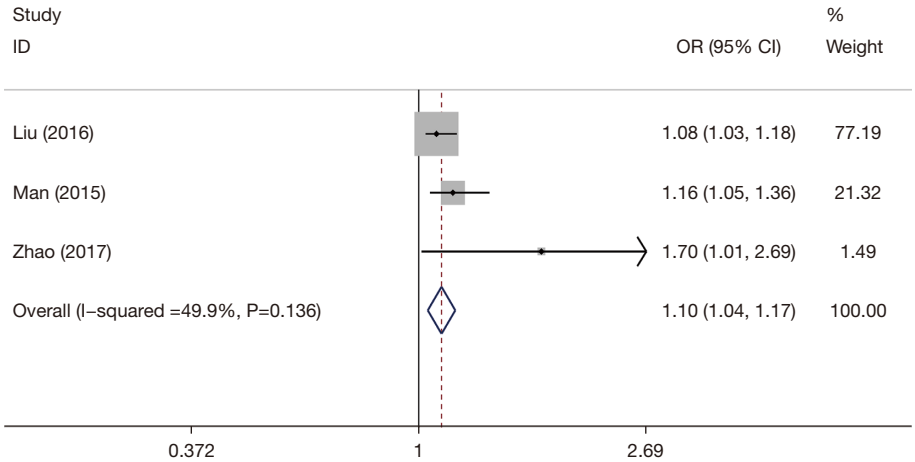

Figure 13 Forest map of high-sensitive C-reactive protein as a risk factor.

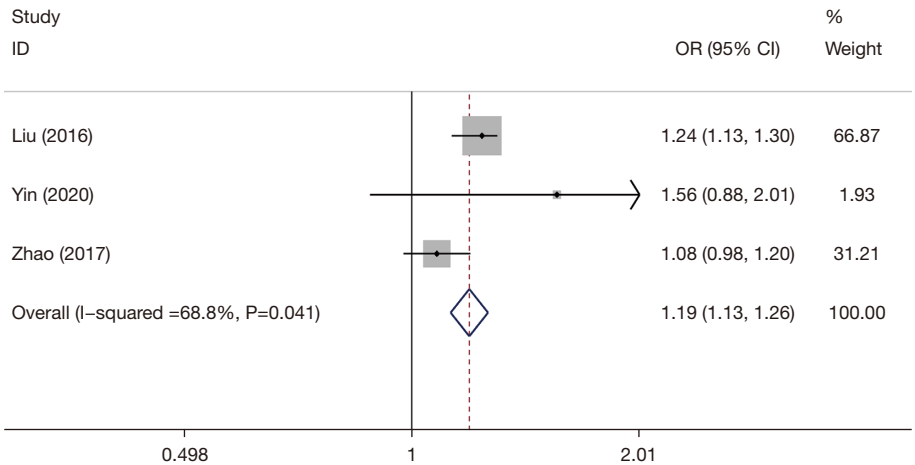

Figure 14 Forest diagram of fasting blood glucose as a risk factor.

among the literatures on hypertension (Chi^2 =1.51, d.f. =1, I^2=33.7%, P=0.219). The fixed effect model is used for analysis, and the combined OR is 1.25, 95% CI is (1.07, 1.47). The overall effect test, Z=2.73, P=0.006, has statistical significance, as shown in *Figure 15*.

Sensitivity analysis

Meta-analysis of the course of diabetes mellitus was conducted by using the random effect model, and the combined OR was 1.10, and the 95% CI was (1.05, 1.15), which was basically the same as that of the fixed effect model, indicating that the meta-analysis result was stable, as shown in *Figure 16*.

Discussion

In recent years, a large number of studies have noted that the occurrence of DR is related to many risk factors, including genes, race, region, age, gender, the course of diabetes, hypertension, lifestyle, and laboratory tests (23). However, due to the interference of various factors, there have been inconsistencies in some of the conclusions reached by the studies. We conducted a meta-analysis to analyze similar results to gather more convincing evidence. Taking into account differences related to regions and races, this meta-analysis mainly focused on the analysis of risk factors for DR in DM patients. The risk factors were divided into two categories (i.e., general patient characteristics and laboratory tests). The objective of this

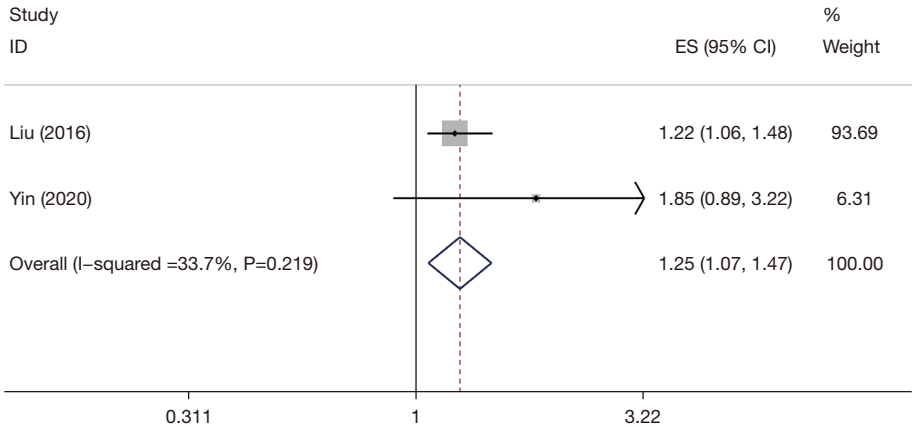

Figure 15 Forest map of hypertension as a risk factor.

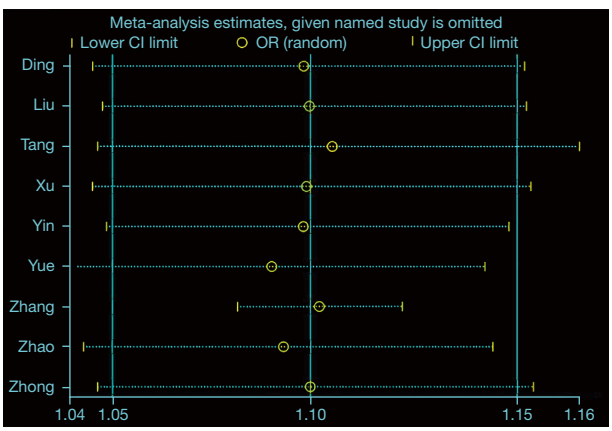

Figure 16 Sensitivity analysis results.

meta-analysis was to comprehensively understand the risks of DR for DM patients. We searched and analyzed 12 articles and found 14 DR-related risk factors. Our findings provide more comprehensive and intuitive results for the prevention and treatment of DR.

The results of this meta-analysis showed that the course of diabetes was a risk factor for DR, which has been widely accepted by scholars. If patients with DM are exposed to hyperglycemia and other risk factors for a long period, the incidence of DR increases as the course of diabetes continues. Additionally, some clinical studies have shown that the course of the disease is correlated with the occurrence of DR, and the results of these studies are consistent with the results of this meta-analysis (24-27).

This meta-analysis also found that SBP and DBP were risk factors for DR. Zhao *et al.* [2017] (28) reached the same conclusion as this meta-analysis, and found that strict blood pressure control within 5 years significantly slows down the occurrence and development of DR. This may be because blood pressure induces the extension of retinal endothelial cells, which leads to the overexpression of kinase insertion domain receptors.

The specific mechanism of DR is complex; however, most studies have found that blood sugar control is related to the development of DR (29,30). Similarly, this meta-analysis found that FBG and HbA1c were risk factors for DR. Further, fasting C-peptide was also found to be a protective factor for DR. This meta-analysis showed that hsCRP is related to the occurrence of DR. A study has shown that chronic inflammation may promote the development of DR, which is consistent with the results of this meta-analysis (31). HsCRP is an inflammatory indicator. Calcium hydroxyphenyl phosphate reduces the occurrence of DR by reducing the expression of hsCRP and endothelin-1 (32).

Conclusions

This study reviewed the relevant literature on DR risk factors and compared a DR group and non-DR group in the meta-analysis to explore the correlation between each risk factor and the occurrence and development of DR. The occurrence of DR was related to the course of diabetes, SBP, HbA1c, total cholesterol, high-density lipoprotein cholesterol, fasting blood glucose, and hypertension. However, this study still had some limitations. The decision of which confounding factors to include in the study was subjective, and the interference of other risk factors could not be completely eliminated. More articles need to be

included in the future to continue to explore the combined effects of multiple factors on DR. All in all, this study comprehensively analyzed the risks for DR and provided a more intuitive and comprehensive scientific basis for the prevention and treatment of DR.

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Footnote

Reporting Checklist: The authors have completed the MOOSE reporting checklist. Available at https://apm.amegroups.com/article/view/10.21037/apm-22-437/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://apm.amegroups.com/article/view/10.21037/apm-22-437/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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