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META-ANALYSIS

Effectiveness and Safety of Astragalus-containing Chinese Medicine Combined with Western Medicine for Diabetes: A Systematic Review and Meta-Analysis

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Abstract: ***Introduction*:** This study aims to comprehensively summarize the clinical evidence comparing the effectiveness and safety of integrating astragalus-containing Chinese medicines with western medicines for T2DM.

***Methods*:** Six databases were searched for eligible studies from inception to June 2023. The aggregated outcomes were expressed as odds ratio (OR) or standardized mean difference (SMD). Random effect model was used for statistical analyses. The risk of bias for included studies was assessed with the Cochrane Risk of Bias Tool. The overall quality of evidence was assessed with the Grades of Recommendations Assessment, Development and Evaluation approach.

***Results*:** The results showed a significant improvement in the FPG (SMD -0.98; 95%CI -1.23, -0.72), 2hPG (SMD -0.94; 95%CI -1.13, -0.76), HbA1c (SMD -0.97; 95%CI -1.18, -0.75), HOMA-IR (SMD -1.07; 95%CI -1.47, -0.66), HOMA-β (SMD 0.84; 95%CI 0.38, 1.31), HDL (SMD 0.41; 95%CI 0.17, 0.66), LDL (SMD -1.17; 95%CI -1.62, -0.72), TC (SMD -0.83; 95%CI -1.06, -0.59) and TG (SMD -0.93, 95%CI -1.20, -0.65) with astragalus-containing TCMs plus conventional therapy comparing to conventional therapy alone. The incidence of hypoglycemia and gastrointestinal tract adverse events was significantly reduced in the combination group. Subgroup analyses based on the type of western medicines, type of traditional Chinese medicines, baseline glucose level, follow-up duration and disease subtypes, all indicated the similar results regarding the superior effectiveness in the combination group.

***Discussion*:** The meta-analyses suggested the astragalus-containing TCMs plus WMs surpassed WMs monotherapy in terms of decreasing the FPG, 2hPG and HbA1c level. Our results were limited by the quality of trials included in the meta-analyses.

***Conclusion*:** Add-on therapy of astragalus-containing TCMs was generally more effective in ameliorating the glycolipid metabolism and improving insulin resistance. The clinical benefits of integrative therapies remained in different subgroup patients.

ARTICLE HISTORY

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1. INTRODUCTION

Type 2 diabetes mellitus (T2DM) represents one of the most prevalent chronic diseases in China [1, 2]. Addressing the increasing threat of diabetes and preventing its 5TH KW. require the development of effective and safe treatments urgently [3]. Although novel treatment strategies for T2DM have increasingly emerged over the last few decades, they are commonly associated with a range of serious adverse events, such as hypoglycemia, gastrointestinal gastrointestinal disorders, musculoskeletal injuries, and infection [4]. Complementary and alternative medicines with a simpler way of use and fewer adverse events than conventional Western treatments have provided new treatment options for T2DM [5]. In China, Traditional Chinese Medicines (TCMs) have been used for a long period of time for both preventing and treating a range of diseases, including T2DM [6, 7]. TCMs, in combination with other non-medical treatments, have shown benefits in alleviating the symptoms of diabetic disorders [8]. For example, the combination of TCMs and vitamin E demonstrated a notable reduction in fasting glucose levels in

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experimental studies [9, 10]. TCM and Western medicines are mutually complemented to promote the growth and development of holistic medicine [11]. Among TCMs, astragalus, also known as Huangqi in China, is one of the most frequently used traditional Chinese herb medicines for treating a diverse range of chronic diseases, including T2DM [12]. Pharmacological studies demonstrated that astragalus possesses anti-inflammatory [13], anti-viral, and anti-bacterial effects [12, 14]. Moreover, astragalus has shown its pharmacological effects in terms of reducing insulin resistance and stimulating the function of pancreatic β cells as well as the insulin secretion cells [12-15]. Astragalus-containing Chinese patent medicines, in combination with Western medicines, have long been used in the treatment of T2DM in case of patients' loss of response or contradiction to previous antidiabetic therapies. Nevertheless, there has been a lack of clinical trials involving substantial sample sizes to explore the effectiveness and safety of TCM that contains astragalus. There is no convincing evidence available to demonstrate the benefits and risks of adding astragalus-containing TCM to Western medicines for T2DM.

Therefore, this research aims to thoroughly compile clinical evidence evaluating the effectiveness and safety of integrating astragalus-containing Chinese medicines versus Western treatments for T2DM in order to demonstrate whether integrated therapy offers additional treatment advantages for T2DM (Tables **S1-S2**).

2. METHODS

This research was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist 2020 [16] (Table **S3**). The protocol was registered in the International Platform of Registered Systematic Review and Meta-analysis Protocols (INPLASY) [17], NO. INPLASY2023110120 (https://inplasy.com/inplasy-2023-11-0120/).

2.1. Literature Search

Three Chinese medical databases (*i.e.*, China National Knowledge Infrastructure, WanFang, and SinoMed) along with three English medical databases (*i.e.*, PubMed, Embase, and Web of Science) were searched from inception until 1st June, 2023. A search strategy was developed using the keywords relevant to T2DM (*e.g.*, diabetes, diabetes mellitus, or xiaoke) and astragalus-containing Chinese medicines (*e.g.*, Tian Qi Jiang Tang (TQJT) granules, Jin Qi Jiang Tang (JQJT) tablet, Shen Qi Jiang Tang (SQJT) granules, Qi Yao Xiao Ke (QYXK) tablet and Xiao Ke pill (XKP). The language of the articles was restricted to English and Chinese.

2.2. Inclusion Criteria

Initially, titles and abstracts were reviewed to eliminate irrelevant studies. Then, the full texts of the remaining studies were assessed to determine their eligibility for inclusion. The studies qualified for inclusion if they met the following criteria: 1) patients diagnosed with T2DM; 2) randomized controlled trials (RCTs) assessing the effectiveness and safety of combining astragalus-containing Chinese patent medicines with Western medicines (WMs) versus WMs alone; 3) RCTs evaluated the following astragalus-containing Chinese medicines recommended by the Chinese guideline for T2DM, including TQJT, JQJT, SQJT, QYXK, and XKP.

2.3. Exclusion Criteria

We excluded studies that met the following criteria: 1) trials recruited patients less than 50; 2) the intervention group was a combination of multiple Chinese medicines, or the control group was a combination of multiple Western medicines; 3) the intervention was acupuncture, psychological supports, lifestyle modifications, and other non-pharmaceutical treatment.

2.4. Types of Outcome Measurements

Effectiveness outcomes of interests included: 1) glucose-related measurements, including FPG, 2hPG and HbA1c; 2) insulin-related measurements, including fasting insulin (FINS), homeostasis model assessment of β-cell function (HOMA-β), and homeostatic model assessment of insulin resistance (HOMA-IR); 3) blood lipid-related measurements, including total triglycerides (TG), total cholesterol (TC), low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Safety outcomes of interest included hypoglycemia events, gastrointestinal tract adverse events, and total adverse events.

2.5. Data Collection and Extraction

Data extraction was conducted using a pre-prepared Excel template. The information collected included: 1) general study characteristics; 2) patient characteristics; 3) details for interventions, including the dosages regime and treatment duration; 4) effectiveness and safety measurements for continuous outcome (*i.e.*, FPG, 2hPG and HbA1c), mean and standard deviation of both baseline prior-treatment value and final post-treatment value were extracted; for dichotomous outcome (*i.e.*, hypoglycemia event), the number of patients experiencing adverse events in combined therapy and monotherapy group was extracted.

2.6. Risk of Bias Assessment

The Cochrane risk of bias tool was used to evaluate the risk of bias in the studies included [18]. The assessment of risk-of-bias was categorized as "low", "high" or "uncertain". The quality of evidence was determined using the Grades of Recommendations Assessment, Development, and Evaluation (GRADE) methodology [19].

2.7. Data Analysis and Synthesis

Statistical analyses were performed using a meta package within R software [20] (version 4.2.2, dated 2022-10-31). Dichotomous data were summarized as odds ratio (OR) with 95% confidence intervals (CIs). For continuous data, the change in mean was computed using

the formula: mean $_{\text{before-treatment}}$ - mean $_{\text{after-treatment}}$. For studies that lacked the SD of the mean difference, we computed the change for SD with the formula: sqrt (SD [2] $_{\text{after-treatment}}$- SD [2] $_{\text{before-treatment}}$ + (2* Corr * SD $_{\text{after-treatment}}$ * SD $_{\text{before-treatment}}$). Corr is assumed to be 0.5 [21]. The results were presented as standardized mean difference (SMD). Quantitative tests χ^2 and I^2 were employed to evaluate the heterogeneity [22]. When P was less than 0.10, or I^2 exceeded 50%, significant heterogeneity was indicated, leading to the use of a random-effects model for meta-analysis; otherwise, a fixed-effect model was adopted for consolidating the data [23].

2.8. Sensitivity Analysis and the Examination of Publication Bias

Sensitivity analysis was conducted with the leave-one-out method [24], successively excluding individual studies and remerging the remaining studies. A funnel plot was drawn to detect potential publication bias [25]. In the case of asymmetry visualized in the funnel plot, trim and fill analyses were carried out to address and correct the asymmetry and to reassess the publication bias by adding a number of missing studies with iterative methods. If the combined estimates were not significantly altered after trim-and-fill analyses [26], it was assumed that potential publication bias had no considerable impact on the overall effect, and the results were relatively stable.

2.9. Subgroup Analysis

In relation to the three main outcomes, FPG, 2hPG, and HbA1c, subgroup analyses were performed to investigate how factors, such as follow-up duration, baseline value, and disease subtypes, influenced the overall findings. Disease subtypes were divided into categories, including newly diagnosed T2DM, patients with inadequate responses to previous treatments, those with insulin resistance, older adults, obese individuals, and those with Qi and Yi deficiency.

Two independent analysts conducted the eligibility assessment, data extraction, bias evaluation, evidence quality appraisal, and data aggregation. Disagreements were addressed through discussions and reached consensus among all authors.

3. RESULT

3.1. Study Selection

At first, 2,792 articles were identified through database searches. After removing duplicates, 1,263 articles were available for initial screening of title and abstract, and 222 articles were selected for full-text review. Eventually, 82 articles met the eligible criteria and were included in the meta-analyses. The study selection flow diagram is presented in Fig. (**1**).

3.2. Study Characteristics

Nine thousand two hundred thirty-eight patients were included in the 82 studies (6 for TQJT tablet, 13 for JQJT tablet, 39 for SQJT capsule, 4 for QYXK capsule, and 21 for XKP). For the WM monotherapy in the control group, 33 studies prescribed metformin, 15 studies prescribed sulfonylureas, 14 prescribed insulin, 7 prescribed DDP-4 inhibitor, 6 prescribed thiazolidinediones, 4 prescribed α-glucosidase inhibitor, and 3 prescribed GLP-1 receptor agonists. The sample size ranged from 50 to 100 in 52 studies, from 101 to 200 in 25 studies, more than 200 in 4 studies, and more than 500 in one study. The follow-up duration of included studies was less than 12 weeks in 34 studies and more than 12 weeks in 48 studies.

3.3. Efficacy Outcomes Based on Post-treatment Value

3.3.1. FPG, 2hPG, and HbA1c

Compared with the WM group, pooled analyses indicated that WM + TCMs significantly decreased the level of FPG (81 studies, 9,095 patients, SMD= -0.98, 95%CI = -1.23 to -0.72), 2hPG (73 studies, 7,575 patients, SMD= -0.94, 95%CI= -1.13 to -0.76), and HbA1c (69 studies, 8,315 patients, SMD= -0.97, 95%CI= -1.18 to -0.75). The pooled results for FPG, 2hPG, and HbA1c are shown in Figs. (**2**-**4**), respectively.

3.3.2. FINs, HOMA-IR, and HOMA-β

Compared with the WM group, pooled analyses indicated that TCMs + WM significantly improved the index of HOMA-IR (24 studies, 2,648 patients, SMD= -1.07, 95%CI = -1.47 to -0.66) and HOMA-β (9 studies, 2,249 patients, SMD= 0.84, 95%CI= 0.38 to 1.31). However, no significant difference in the level of FINs (20 studies, 1,616 patients, SMD= -0.13, 95% CI= -0.65 to 0.40) was found between TCMs + WM group and WM monotherapy group.

The pooled results for FINs, HOMA-IR, and HOMA-β are shown in Fig. (**5**).

3.3.3. HDL, LDL, TC, and TG

Compared with the WM group, pooled analyses indicated that TCMs + WM significantly elevated HDL (20 studies, 2,795 patients, SMD= 0.41, 95%CI = 0.17 to 0.66) and decreased LDL (19 studies, 2,200 patients, SMD= -1.17, 95%CI = -1.62 to -0.72), TC (31 studies, 3,373 patients, SMD= -0.83, 95%CI = -1.06 to -0.59), and TG (29 studies, 2,668 patients, SMD= -0.93, 95% CI = -1.20 to -0.65).

The pooled results for LDL, HDL, TG, and TC are shown in Fig. (**6**).

3.4. Safety Outcomes

Compared with the WM group, pooled analyses reported a lower incidence of hypoglycemia events (19 studies, 2,646 patients, OR = 0.49, 95% CI = 0.33 to 0.73) (Fig. **7a**) and

gastrointestinal tract adverse events (20 studies, 1,950 patients, OR = 0.52, 95% CI = 0.36 to 0.77) in the WM + TCMs group (Fig. **7b**). No significant difference was found in total adverse events between two groups (20 studies, 2,152 patients, OR = 0.67, 95% CI = 0.42 to 1.08) (Fig. **7c**).

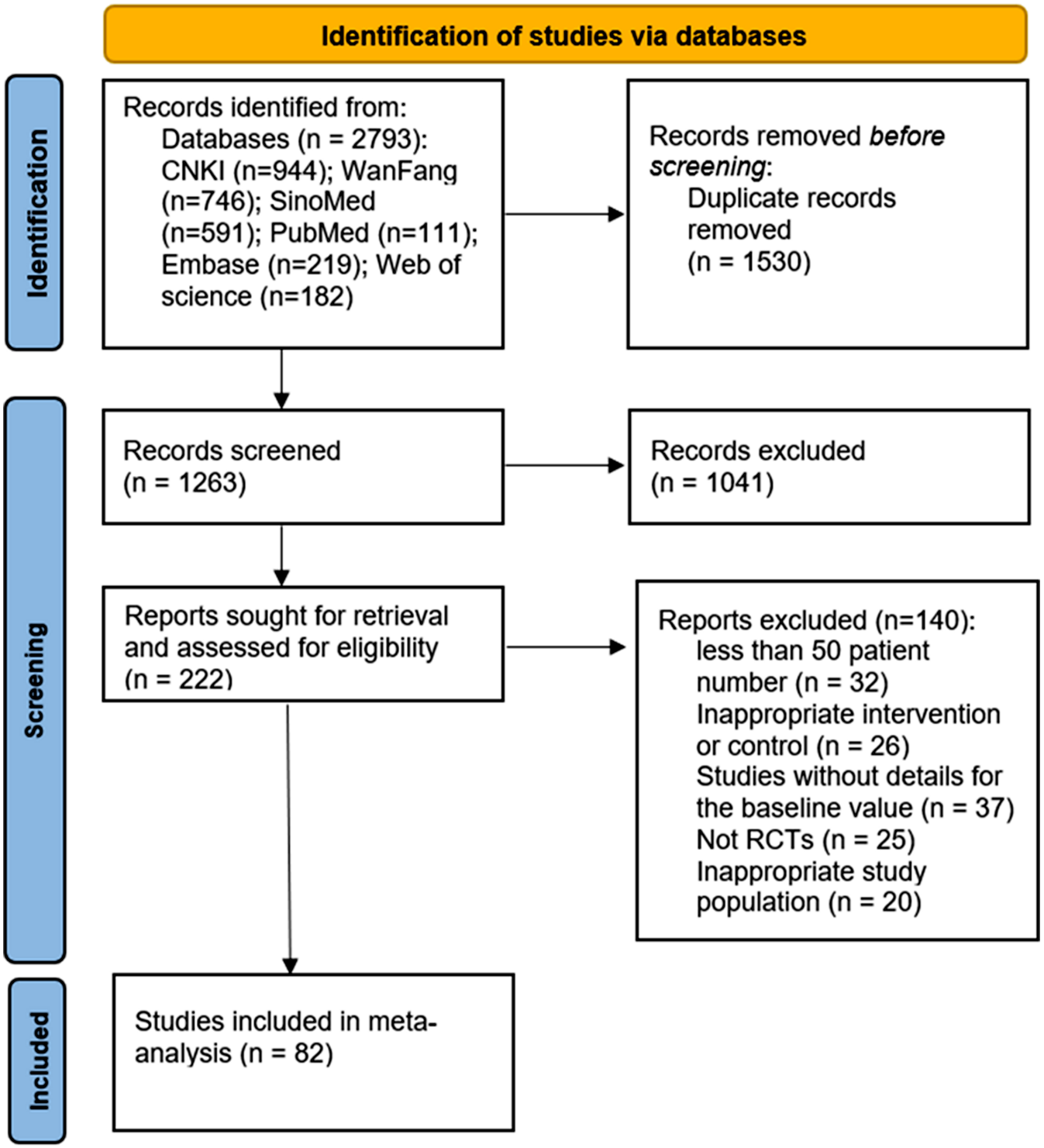

Fig. (1). PRISMA flow diagram for study selection. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

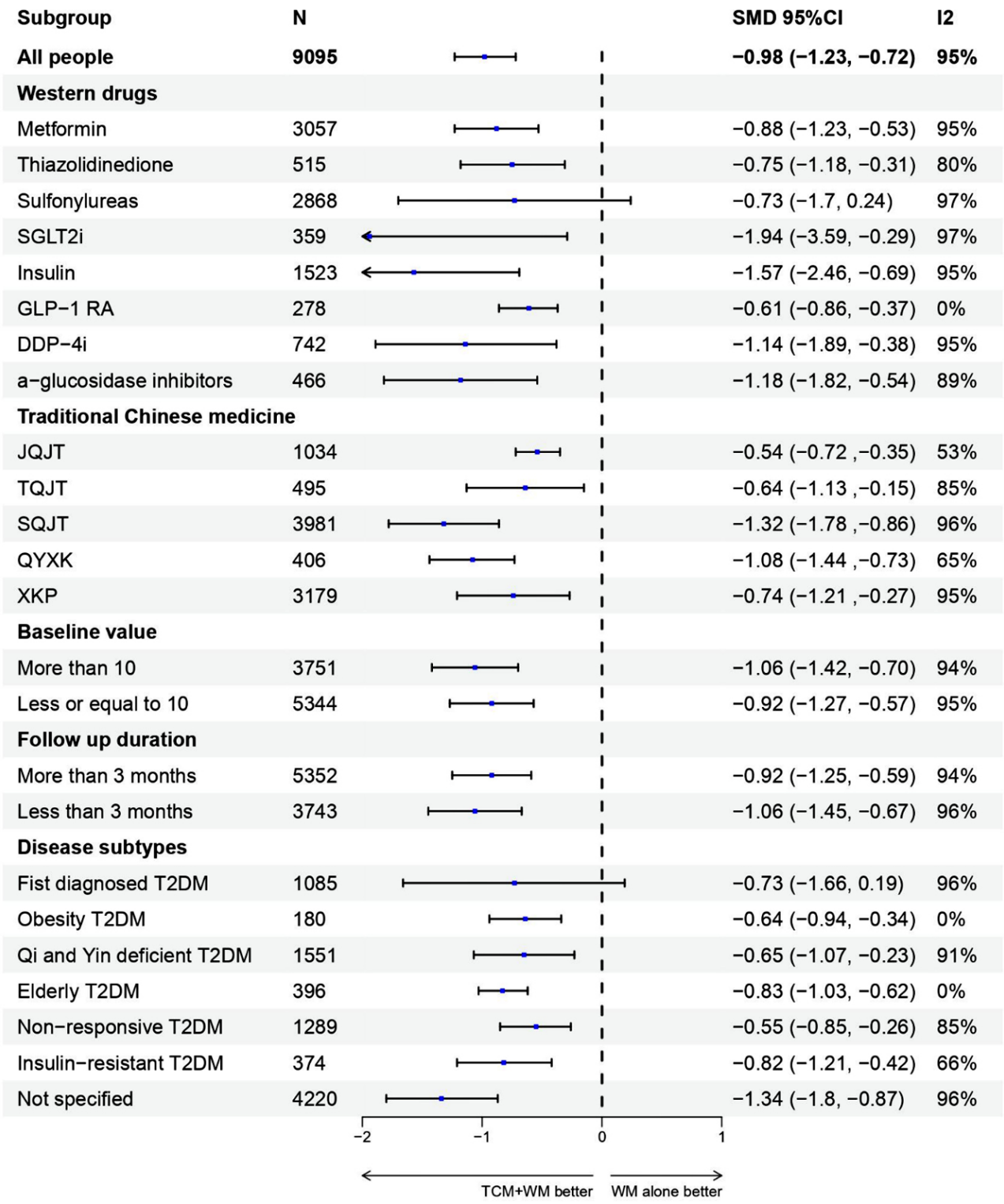

Fig. (2). Comparison between astragalus-containing TCMs + Western drugs versus Western drugs on the outcome of FPG. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

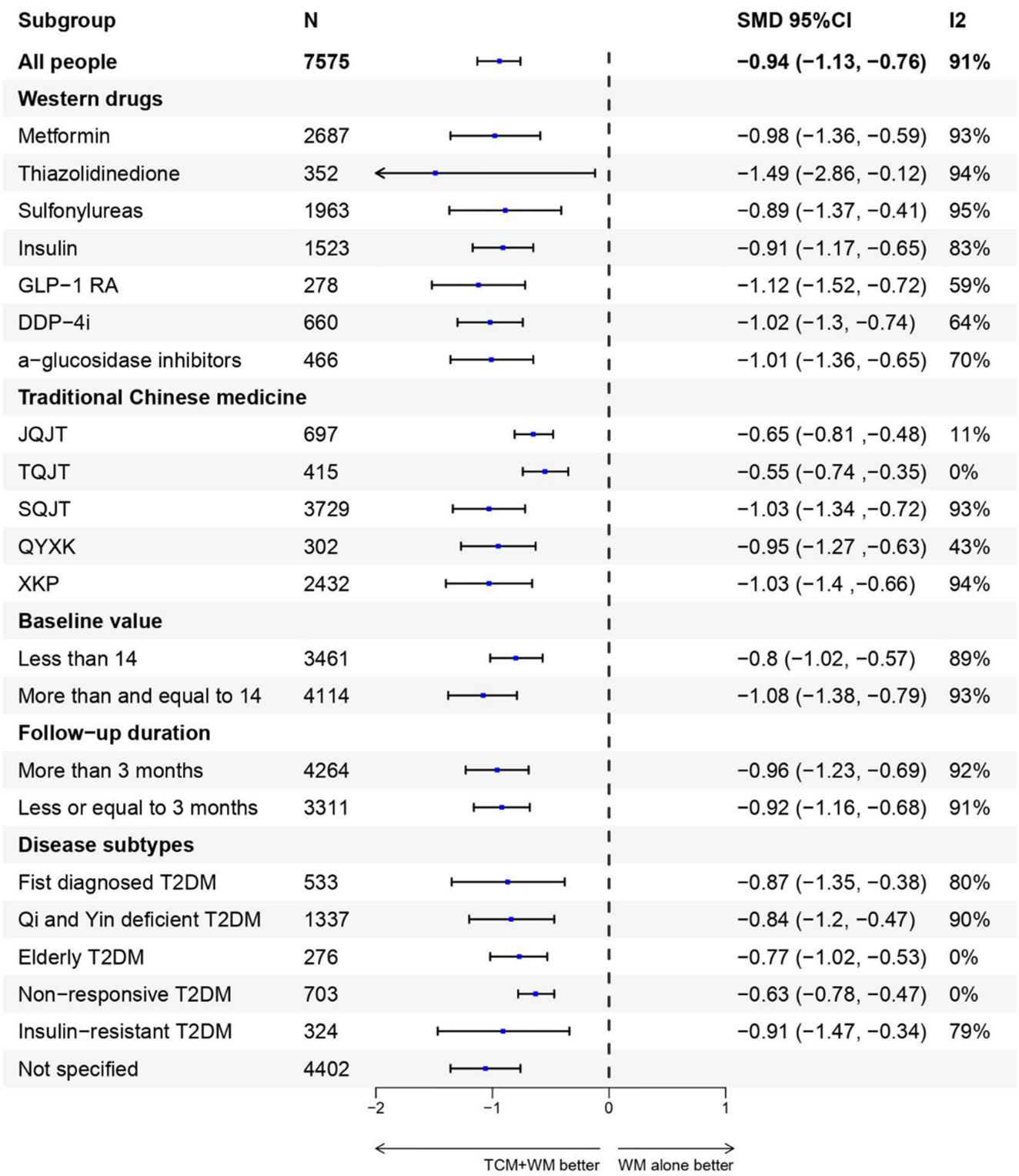

Fig. (3). Comparison between astragalus-containing TCMs + Western drugs versus Western drugs on the outcome of 2hPG. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

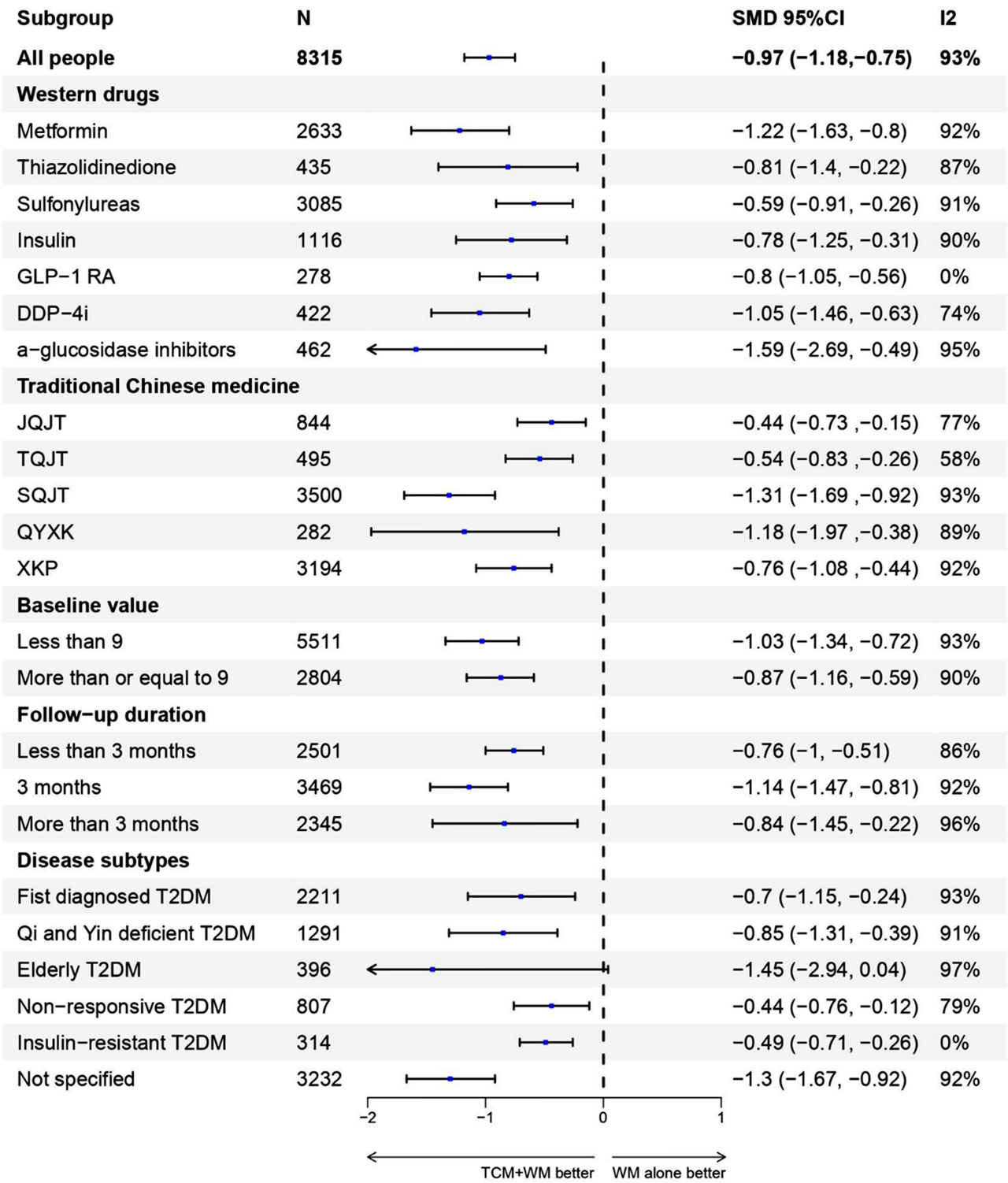

Fig. (4). Comparison between astragalus-containing TCMs + Western drugs versus Western drugs on the outcome of HbA1c. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

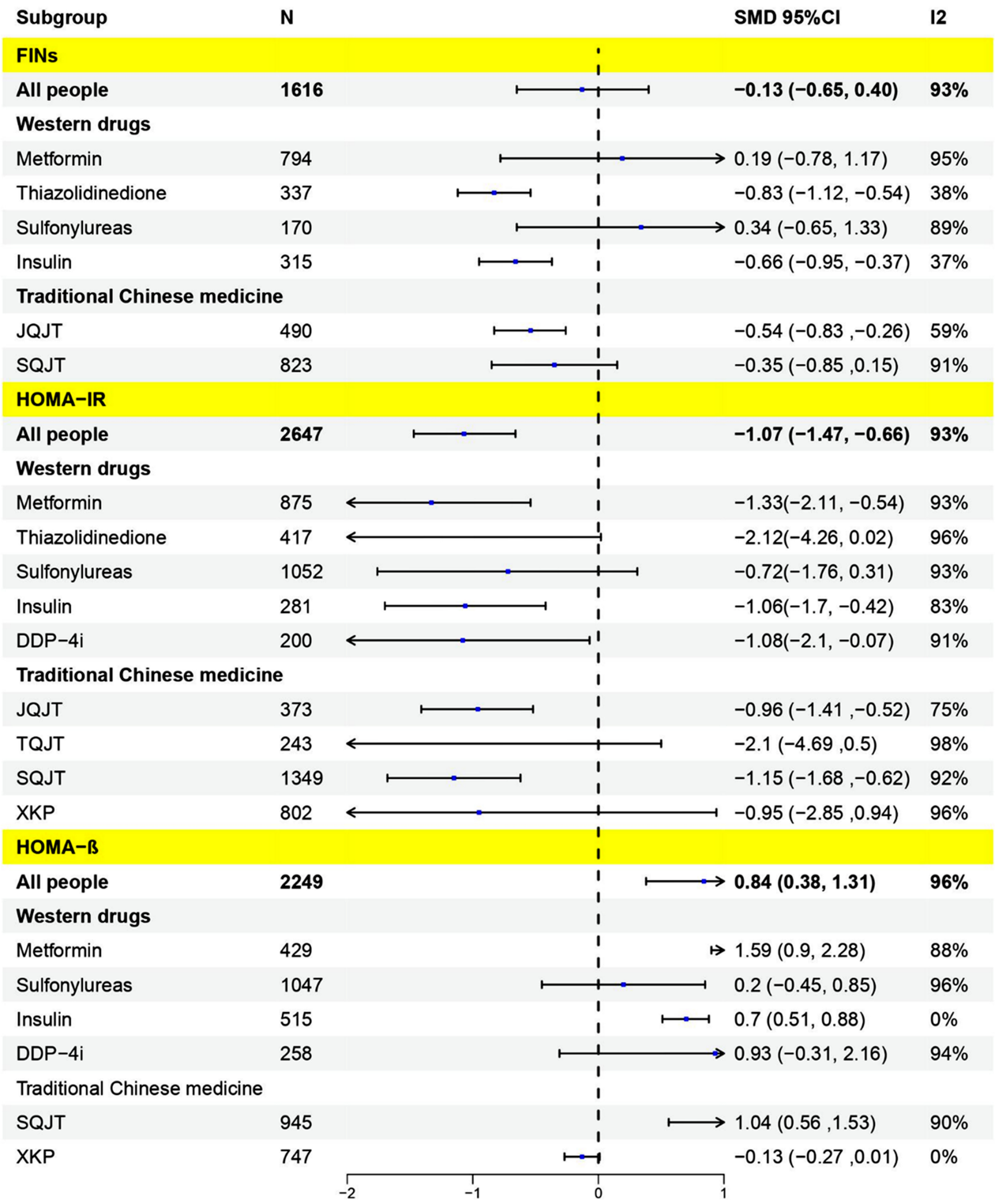

Fig. (5). Comparison between astragalus-containing TCMs + Western drugs versus Western drugs on the outcome of FINs, HOMA-IR, and HOMA-β. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

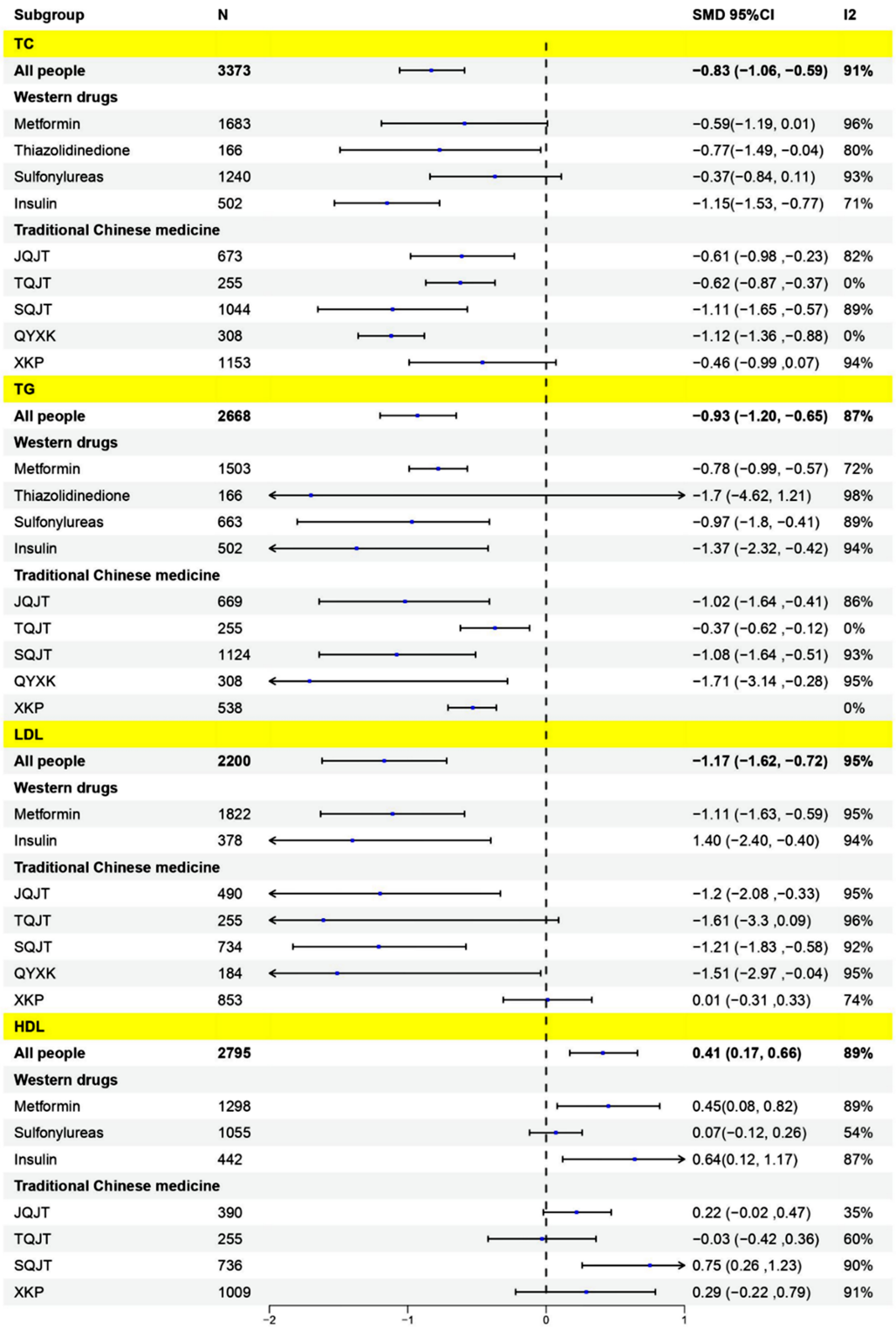

Fig. (6). Comparison between astragalus-containing TCMs + Western drugs versus Western drugs on the outcome of TC, TG, LDL, and HDL. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

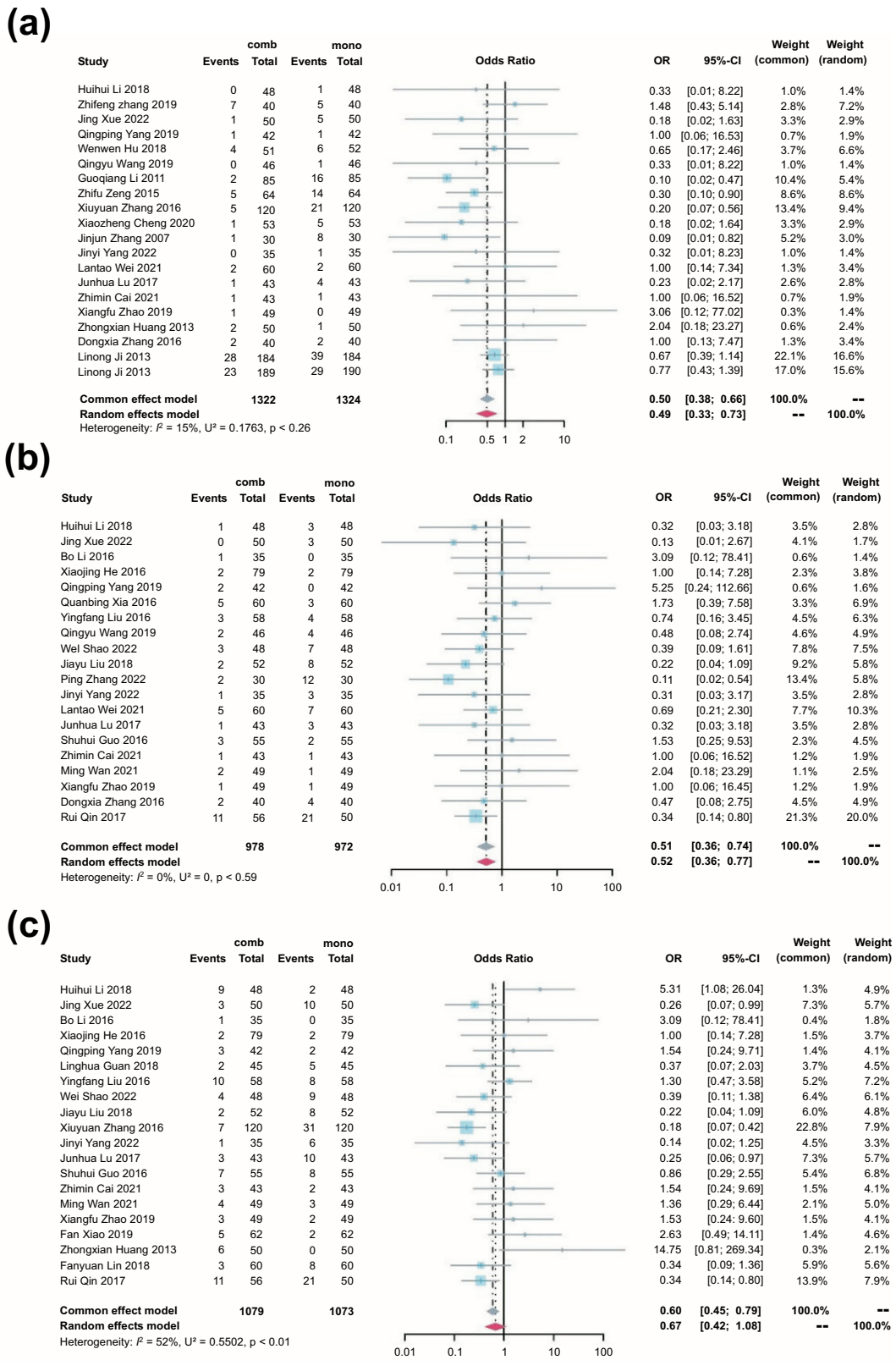

Fig. (7). Comparison between astragalus-containing TCMs + Western drugs versus Western drugs on the outcome of hypoglycemia event (**a**), GI event (**b**), and all AEs (**c**). *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

3.5. Change Value

Compared with the WM group, pooled analyses indicated that all TCMs + WM combinations (sulfonylureas, metformin, insulin, thiazolidinedione, DDP-4i, a-glucosidase inhibitors, and GLP-1RA) significantly reduced the FPG, h2PG, and HbA1c levels.

3.6. Subgroup Analysis

For the outcome of FPG, 2hPG, and HbA1c, subgroup analyses of specific TCMs indicated that adding JQJT, TQJT, QYXK, SQJT, and XKP to WM treatment were all more effective than WM alone. Regarding the specific WM subgroup, all combined groups, including sulfonylureas, metformin, insulin, DDP-4i, thiazolidinedione, a-glucosidase inhibitors, and GLP-1RA significantly improved the FPG, 2hPG, and HbA1c compared to WM monotherapy. The results for subgroup analyses of FPG, 2hPG, and HbA1c are shown in Figs. (**2**-**4**), respectively.

For the outcomes of HOMA-IR, HOMA-β, and FINs, subgroup analyses of specific TCMs revealed significant differences in the HOMA-IR index for the WM + JQJT and WM + SQJT groups, in the HOMA-β index for the WM + SQJT group, and in FINs for the WM + JQJT group. Regarding the subgroup analyses of specific WM, a significant difference was observed in the index of HOMA-IR in all WM+TCMs subgroups (with the exception of the sulfonylureas combination group), HOMA-β in the insulin + TCMs and metformin + TCMs group, and FINs in the insulin + TCMs and thiazolidinedione +TCMs group (Fig. **5**).

For the outcome of LDL, HDL, TC, and TG, subgroup analyses of specific TCMs detected significant differences in HDL in the WM + SQJT group, LDL in the WM + JQJT, WM + SQJT, and WM + QYXK groups, TC in the WM + JQJT, WM + TQJT, WM + SQJT, and WM + QYXK groups, and TG in all five WM + TCMs groups. Regarding the subgroup analyses of specific WM, a significant difference was suggested in the metformin +TCMs and insulin + TCMs groups in HDL and LDL, insulin + TCMs and Thiazolidinedione + TCMs in TC, and insulin + TCMs, sulfonylureas + TCMs, and metformin + TCMs groups in TG (Fig. **6**).

Subgroup analyses consistently suggested that TCMs + WM significantly decreased the levels of FPG, 2hPG, and HbA1c compared to WM alone, irrespectively of baseline value before treatment (FPG ≤ 10 vs. FPG >10; h2PG ≤ 14 vs. h2PG >14; HbA1c >9 vs. HbA1c <9), disease subtypes, and follow-up duration (< 3 months vs. ≥ 3 months). No statistical between-subgroup difference was observed for all three outcomes. The results for subgroup analyses for FPG, 2hPG, and HbA1c are shown in Figs. (**2**-**4**), respectively.

3.7. Sensitivity Analyses

The sequential exclusion of individual studies in the sensitivity analysis indicated that the overall estimations remained robust across all the examined outcomes, which encompassed FPG, 2hPG, HbA1c, LDL, HDL, TC, TG, FINs, HOMA-IR, and HOMA-β (Figs. **S1a** to **S10a**).

3.8. Publication Bias

The funnel plot suggested asymmetry across studies in all the investigated outcomes, implying that the existence of possible publication bias could not be ruled out. A trim-and-fill analysis was performed to assess how publication bias might affect the combined results. It demonstrated that the combined results before and after clipping remained significant for FPG, 2hPG, and HbA1c, indicating that the results were relatively stable and were not significantly affected by publication bias. Nevertheless, the combined results for HOMA-IR, HOMA-β, LDL, HDL, TG, and TC became insignificant in the trim-and-fill analysis. The funnel plots for each outcome are shown in Figs. (**S1b** to **S10b**), and the results for trim-and-fill analyses are presented in Table **S1**.

3.9. Methodological Quality Assessment

Fig. (**8**) summarizes the overall risk of bias for all included studies. In this study, 39 out of 82 studies reported detailed methods for the randomization process (*e.g.*, random number table, coin toss), while the remaining 43 studies mentioned "random allocation", without providing information on the randomization method. No studies described whether allocation concealment was implemented. Only one study was a double-blind study; three studies were single-blind studies, while the rest of the studies resembled open-label studies due to the absence of information on blinding. All studies were rated as having a low risk of bias regarding incomplete outcome data and selective reporting. Eleven studies were classified as having an unclear risk for other potential biases, considering that scarce information was available to conclude the similarities and comparability between the intervention and control groups.

Regarding the GRADE assessment, the evidence on hypoglycemia rate and GI event was downgraded to moderate quality due to the uncertain risk of bias of included studies. The quality of evidence for FPG, 2hPG, HbA1c, FINs, HOMA-β, HOMA-IR, HDL, LDL, TC, and TG was rated as low due to unclear risk of bias in the included studies, statistical heterogeneity, and potential publication bias (Table **S2**). The references for the included 82 studies were provided at the end of the supplementary material.

4. DISCUSSION

This study was the first research to provide a systematic, evidence-based overview of the RCTs investigating the effectiveness and safety of astragalus-containing TCMs for T2DM. The meta-analyses suggested the astragalus-containing TCMs plus WMs surpassed WMs monotherapy in terms of decreasing the FPG, 2hPG, and HbA1c levels. For the improvement of insulin resistance, astragalus-containing TCMs plus WMs significantly improved the HOMA-β and HOMA-IR. However, no

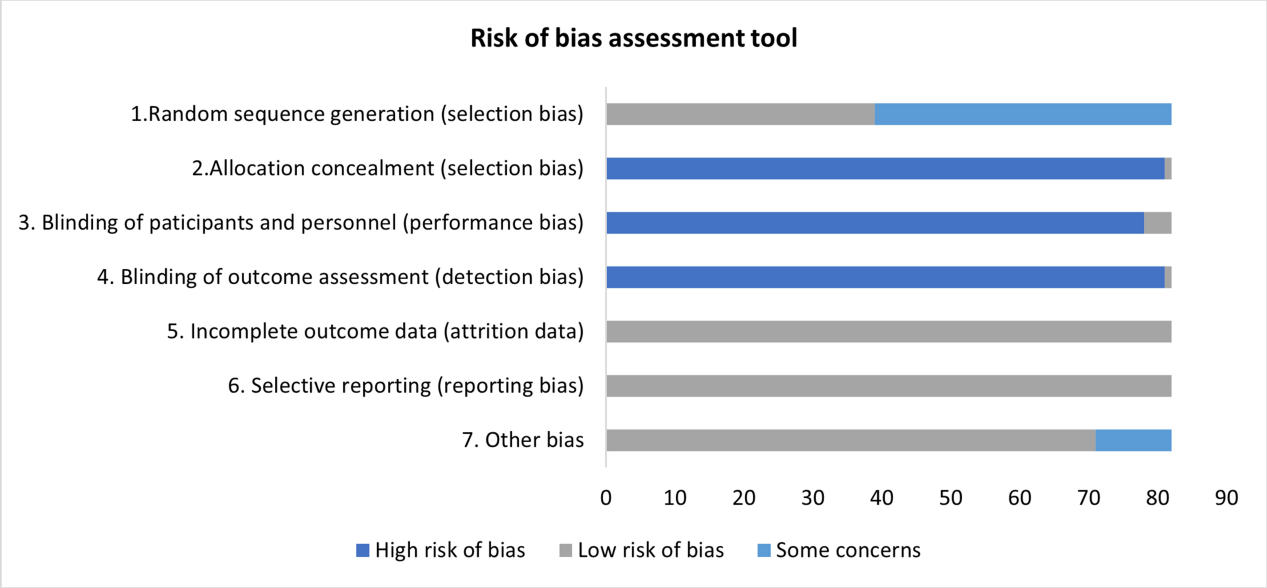

Fig. (8). Risk of bias assessment for included studies. *(A higher resolution / colour version of this figure is available in the electronic copy of the article).*

significant difference was observed in FINs between the two groups. Regarding lipid metabolism, astragalus-containing TCMs significantly ameliorated the LDL-C, HDL-C, TC, and TG. Subgroup analyses indicated that TCMs plus WM therapy was consistently more effective in regulating the glucose level compared to WM monotherapy, regardless of baseline value before treatment, follow-up duration, and disease subtypes.

4.1. Limitations in the Methodology of the Included Studies

Although we tried our utmost to make the analyses as reliable and precise as possible, our results were limited by the quality of trials included in the meta-analyses. In general, only a small number of studies explicitly mentioned that they followed Consolidated Standards of Reporting trials (CONSORT) guidelines for conducting RCTs [27]. As aforementioned, many of the included studies provided no clarifications on the methodology of the randomization process, allocation concealment, and blinding to patients and study researchers, leading to some of the included studies being evaluated with a high risk of bias [28]. Moreover, sparse information was available on the process of patient selection and sample size estimation [29], which may constitute one of the major sources of publication bias [30, 31]. Additionally, the short follow-up duration of included studies restricted our capacity to investigate the long-term outcomes, such as the occurrence of microvascular and macrovascular complications as well as mortality [32]. Moreover, most of the included studies provided no clear descriptions of the dropouts and withdrawals, and if they occurred, the methods for dealing with the missing data were rarely reported [33].

4.2. Quality of the Evidence

The GRADE evaluation determined that the evidence confidence was rated as low, mainly because of the high risk of bias of the studies included, significant heterogeneity, and potential publication bias. The possible publication bias could likely be attributed to the evidence being derived from several small studies. Compared to RCTs with large numbers of patients, small studies are more likely to remain unpublished because they hold a higher possibility of reaching statistically negative or insignificant results between intervention and control groups [34]. However, it is noteworthy that visual assessment of funnel plots remains prone to error, and the asymmetry may not be a straightforward indicator of publication bias [34]. To compensate for the limitations of the funnel plot, a "trim-and-fill" analysis was carried out to further explore the presence of publication bias [35]. It turns out that the differences between the intervention group and control group for primary outcomes (*i.e.*, FPG, 2hPG, and HbA1c) remained significant with the "trim-and-fill" analysis [36], indicating that the integrated results were relatively robust. The observed I^2 test $\geq$ 50 implied the significant heterogeneity between included studies [37], which constituted another rationale for downgrading the quality of evidence. Nonetheless, it should be noted that in the case of many studies included in the meta-analysis, the I^2 test held high power to detect minor heterogeneity that could be of limited clinical significance [38].

4.3. Strengths of our Study

As per our knowledge, this study represented the most thorough review of the available evidence on the effectiveness of five individual astragalus-containing TCMs.

To examine the robustness of the aggregated results in a multifaceted way, we focused not only on post-treatment values but also on the changed values. Using change values for analyses could be more effective and robust than comparing final values, as it eliminates some of the variability between individuals [39]. Therefore, the imprecise and inaccuracy of merged results due to the incomparability of patient characteristics could be minimized. Additionally, subgroup analyses on the specific TCM and WM were also performed to examine whether the complementary advantages of TCMs consistently existed when different combination regimes were considered [40]. Moreover, subgroup analyses of different baseline values were also conducted to investigate whether the therapeutical advantages of TCMs + WM were more evident in particular subgroup patients. The results demonstrated that the TCM and WM combinations were constantly more effective than the WM monotherapy group, irrespective of a higher or lower baseline value, whereas no significant difference was detected between subgroups.

CONCLUSION

The available evidence indicated that conventional Western therapies in combination with astragalus-containing TCMs were more effective than Western therapies alone in ameliorating the FPG, 2hPG, HbA1c, HOMA-IR, HOMA-β, HDL, LDL, TC, and TG, without significantly increasing the incidence of hypoglycemia event, gastrointestinal tract related adverse events, and overall adverse events. However, the quality of evidence is generally low, highlighting the necessity of conducting RCTs with rigorous study design to provide more conclusive evidence on the clinical effectiveness and safety of astragalus-containing TCMs combined therapy in the future.

AUTHORS' CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: study conception and design: M.T.; and D.Y.; data collection: T.Q.; and X.Y.; methodology: S.Z. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

2hPG	=	2 Hours Postprandial Glucose
APS	=	Astragalus Polysaccharides
DPP-4	=	Dipeptidyl Peptidase 4
FINS	=	Fasting Insulin
FPG	=	Fasting Plasma Glucose
GI	=	Gastrointestinal Tract
GLP-1	=	Rasglucagon-like Peptide-1 Receptor Agonists
GRADE	=	Grades of Recommendations Assessmentdevelopment and Evaluation
HbA1c	=	Hemoglobin A1c
HDL	=	High-density Lipoprotein
HOMA-IR	=	Irhomeostatic Model Assessment of Insulin Resistance
HOMA-β	=	Bhomeostasis Model Assessment of B-cell Function
JQJT	=	Jinqi Jiangtang
LDL	=	Low-Density Lipoprotein
OR	=	Odds Ratio
PRISMA	=	Prospective Register of Systematic Reviews
QYXK	=	Qiyao Xiaoke Capsule
RCTs	=	Randomized Controlled Trials
SGLT2	=	Sodium-glucose Cotransporter-2
SMD	=	Standardized Mean Difference
SQJT	=	Shenqi Jiangtang
T2DM	=	Type 2 Diabetes Mellitus
TC	=	Total Cholesterol
TCMs	=	Traditional Chinese Medicines
TG	=	Triglycerides
TQJT	=	Tianqi Jiangtang
WM	=	Western Medicines
XKP	=	Xiaoke Pill

CONSENT FOR PUBLICATION

Not applicable.

STANDARDS OF REPORTING

PRISMA guidelines and methodology were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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SUPPLEMENTARY MATERIAL

PRISMA checklist is available as supplementary material on the publisher's website along with the published article.

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