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A Meta-analysis of the effects of education on self-management in patients with type 2 diabetes

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ADMINISTRATIVE INFORMATION

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 September 2025 and was last updated on 26 September 2025.

INTRODUCTION

Review question / Objective This meta-analysis aimed to evaluate the impact of empowerment education on self-management ability, glycated hemoglobin (HbA1c), fasting plasma glucose (FPG), and body mass index (BMI) in adults with Type 2 diabetes mellitus (T2DM).

Condition being studied Type 2 diabetes mellitus (T2DM) is one of the most common chronic diseases worldwide, characterized by insulin resistance and a progressive decline in β-cell function[1]. As the global incidence of T2DM continues to rise, its complications—ranging from cardiovascular disease to neuropathy—pose significant threats to patients' quality of life and healthcare systems[2, 3]. Effective management of T2DM typically involves a multifaceted approach encompassing lifestyle modification (dietary control and regular exercise), pharmacotherapy, and continuous self-monitoring of blood glucose levels[4, 5]. Empowerment education, also known as empowerment-oriented DSMES, refers to a patient-centered approach that emphasizes autonomy, self-efficacy, and shared decision-making, distinguishing it from traditional didactic diabetes education,Previous systematic reviews of DSMES have demonstrated improvements in glycemic control and psychosocial outcomes, but few have specifically isolated empowerment-oriented approaches as distinct interventions[6, 7].

METHODS

Search strategy A systematic search was conducted in both Chinese and English databases, including PubMed, Embase, the Cochrane Library, China National Knowledge Infrastructure (CNKI), Wanfang Database, and VIP Database. The search included studies published before April 1, 2025. Search keywords included "Type 2 diabetes," "self-management," "empowerment education,"

"randomized controlled trial," and "Meta-analysis." Both subject terms and free-text terms were used in the search strategy.

Participant or population Adult patients diagnosed with type 2 diabetes.

Intervention Intervention: Interventions were classified as empowerment-oriented DSMES if they included at least one empowerment component (patient-driven goal setting, problem-solving training, self-efficacy building, or shared decision-making) in addition to standard DSMES content; programs limited to didactic education without these components were excluded. Control group: received routine care or standard health education.

Comparator Intervention: Interventions were classified as empowerment-oriented DSMES if they included at least one empowerment component (patient-driven goal setting, problem-solving training, self-efficacy building, or shared decision-making) in addition to standard DSMES content; programs limited to didactic education without these components were excluded. Control group: received routine care or standard health education.

Study designs to be included Study type: randomized controlled trial (RCT).

Eligibility criteria Inclusion Criteria:1. Study type: randomized controlled trial (RCT). 2. Participants: adult patients diagnosed with type 2 diabetes.3. Intervention: Interventions were classified as empowerment-oriented DSMES if they included at least one empowerment component (patient-driven goal setting, problem-solving training, self-efficacy building, or shared decision-making) in addition to standard DSMES content; programs limited to didactic education without these components were excluded. 4. Control group: received routine care or standard health education.5. Reported clear data on self-management ability or related secondary outcomes (e.g., HbA1c, FPG, BMI) including means and standard deviations.
Exclusion Criteria:1. Study design was not an RCT or not a clinical study. 2. Duplicate publication or incomplete data that could not be supplemented. 3. Articles not in Chinese or English.

Information sources Two researchers independently conducted an initial screening, full-text screening, and data extraction. Discrepancies were resolved by discussion or through arbitration by a third party. Extracted data included author, publication year, country or region, sample size, intervention measures, control measures, duration of the intervention, and mean and standard deviation for primary and secondary outcome indicators.

Main outcome(s) Self-management ability was defined as the capacity of patients to engage in diabetes self-care behaviors and related competencies, including medication adherence, glucose monitoring, diet, physical activity, problem-solving, and psychosocial self-efficacy. Across studies, this construct was measured using validated instruments such as the Diabetes Empowerment Scale (DES), DES–Short Form, Diabetes Self-Care Activities (SDSCA), Diabetes Distress Scale (DDS), Knowledge–Attitude–Practice (KAP) questionnaire, and program-specific evaluation tools (Table 2). Because these instruments differ in content and scoring range, standardized mean differences (SMDs, Hedges g) were used to pool results, thereby allowing comparability across heterogeneous scales.

Additional outcome(s) Secondary outcomes included glycemic and anthropometric indicators: glycated hemoglobin (HbA1c, %), fasting plasma glucose (FPG, mmol/L), and body mass index (BMI, kg/m^2). These outcomes were extracted as mean values with standard deviations and analyzed as mean differences (MDs) when units were consistent across trials.

Quality assessment / Risk of bias analysis The quality of the included studies was evaluated using the Cochrane risk-of-bias assessment tool, covering random sequence generation, allocation concealment, blinding, completeness of outcome data, selective reporting, and other potential biases. Two researchers independently conducted the quality assessment; disagreements were resolved by discussion to reach a consensus.

Strategy of data synthesis Meta-analysis was performed using R software (version 4.0.5). For continuous variables, the standardized mean difference (SMD) and its 95% confidence interval (95% CI) were used to pool effect sizes. We corrected unit-of-analysis error using a design-effect approach: $DE = 1 + (m - 1) \times ICC$, where m is the average cluster size and ICC the intracluster correlation. Trial-reported ICCs were used when available; otherwise ICC = 0.02 was assumed and varied (0.01–0.05) in sensitivity checks. Effective sample sizes were divided by DE for each arm (means and SDs unchanged) prior to pooling. Heterogeneity was assessed using I^2 and the Q-test. An $I^2 > 50\%$ indicated substantial

heterogeneity, in which case a random-effects model was used; otherwise, a fixed-effects model was employed. Funnel plots and sensitivity analyses were used to evaluate the stability of the results and the risk of publication bias. A p-value < 0.05 was considered statistically significant.Two researchers independently conducted an initial screening, full-text screening, and data extraction. Discrepancies were resolved by discussion or through arbitration by a third party. Extracted data included author, publication year, country or region, sample size, intervention measures, control measures, duration of the intervention, and mean and standard deviation for primary and secondary outcome indicators.

Subgroup analysis Secondary outcomes included glycemic and anthropometric indicators: glycated hemoglobin (HbA1c, %), fasting plasma glucose (FPG, mmol/L), and body mass index (BMI, kg/m^2). These outcomes were extracted as mean values with standard deviations and analyzed as mean differences (MDs) when units were consistent across trials.

Sensitivity analysis Sensitivity analysis(Figure 7) showed that excluding each study one by one yielded overall effect sizes ranging from 0.61 to 0.84, all of which remained statistically significant, suggesting good stability of the findings. Excluding the study by Zhou (2016) lowered the effect size to 0.61 (95% CI: 0.14–1.09), while excluding the study by Anderson (2009) increased it to 0.84 (95% CI: 0.35–1.34). Although the effect size fluctuated slightly, statistical significance was maintained.

Country(ies) involved China.

Keywords Type 2 diabetes mellitus; Empowerment education; Self-management; Glycemic control; Meta-analysis.

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