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ORIGINAL ARTICLE

Efficacy of acceptance and commitment therapy for people with type 2 diabetes: Systematic review and meta-analysis

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ABSTRACT

Aims/Introduction: This systematic review and meta-analysis aimed to investigate the efficacy and safety of acceptance and commitment therapy (ACT) for people with type 2 diabetes mellitus.

Materials and Methods: Several electronic databases were examined on 16 January 2021, including PubMed, CENTRAL, PsycINFO, International Clinical Trials Registry Platform and ClinicalTrials.gov. Randomized controlled trials were included to compare ACT with usual treatment for people with type 2 diabetes reported in any language. Primary outcome measures were glycated hemoglobin, self-care ability assessed by the summary of diabetes self-care activities and all adverse events. The secondary outcome measure was acceptance assessed by the acceptance and action diabetes questionnaire.

Results: Of 678 publications initially identified, three trials were included in the meta-analysis. ACT resulted in a reduction in glycated hemoglobin (mean difference −0.62 points lower in the intervention group; 95% confidence interval −1.07 to −0.16; I^2 = 0%; low-quality evidence). In addition, ACT increased the score of the summary of diabetes self-care activities (mean difference 8.48 points higher in the intervention group; 95% confidence interval 2.16–14.80; high-quality evidence). Adverse events were not measured in all trials. ACT increased scores of the acceptance and action diabetes questionnaire (mean difference 5.98 points higher in the intervention group; 95% confidence interval, 1.42–10.54; I^2 = 43%; low-quality evidence).

Conclusions: ACT might reduce glycated hemoglobin, and increase self-care ability and acceptance among people with type 2 diabetes.

INTRODUCTION

Type 2 diabetes mellitus is characterized by relative insulin deficiency and insulin resistance[1]. There are many antidiabetic medications have been approved for type 2 diabetes[1]. However, the efficacy of these drugs does not extend to lifestyle modification. A recent cluster randomized trial showed that significant weight loss led to remission of type 2 diabetes, affirming the need for diet and exercise therapy[2]. Lifestyle modification in addition to medication is important to control type 2 diabetes[1].

Several types of lifestyle modification education based on the theory of behavioral change and interventions using psychotherapy have been introduced to clinical practice[3]. Various types of psychotherapy have been most reported to improve glycated hemoglobin (HbA_{1c})[4]. Conventional cognitive behavioral therapy

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(CBT) has been reported to be effective in lowering HbA_{1c}[5]. Conventional CBT focuses on reducing, changing or stopping negative thoughts and behaviors related to diabetes[6,7]. However, existing CBT is often used for diabetes complicated by depression[8–11], and research on CBT evaluating self-care ability is limited. Acceptance and commitment therapy (ACT) is a promising new type of CBT[2]. ACT is a psychological intervention that uses mindfulness, acceptance and behavior change to increase psychological flexibility, and is thought to offer more benefits than other interventions[2]. The implementation of ACT has shown positive outcomes on a wide range of issues, including substance abuse, chronic pain, anxiety, ability to cope with depression, smoking cessation, prejudice, work stress and obsession. ACT focuses on acceptance of thoughts that emphasize values and clarity of personal goals[12]. In other words, ACT is characterized by dealing with the issue of lifestyle rather than symptoms, whereas conventional CBT deals with the content and frequency of cognition. ACT focuses on acceptance of thoughts that emphasize values and clarity of personal goals[12].

No systematic review has been reported that evaluates the efficacy of ACT for diabetes mellitus. If ACT is shown to be effective for type 2 diabetes patients, it would increase treatment options. Therefore, the present study aimed to investigate the efficacy and safety of ACT for people with type 2 diabetes mellitus.

MATERIALS AND METHODS

The present study was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement (Appendix S1)[13]. Before carrying out this study, the protocol was registered in R000042173 of the university hospital medical information (UMIN) clinical trials registry (CTR) (https://upload.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000042173).

Eligibility criteria

Type of study

All published and unpublished randomized controlled trials (RCTs), including conference abstracts and letters, were included. Cross-over studies, cluster randomized studies, quasi-studies and non-randomized trials were excluded. Studies in any country and in any language were eligible for screening. Studies were included regardless of the follow-up period.

Participants

Participants were people with type 2 diabetes aged ≥18 years diagnosed with a standard diagnostic system, such as the global guideline for type 2 diabetes[14]. Sex, race and environment were not considered. People with gestational diabetes and people with elevated blood glucose levels that could not be diagnosed using standard diagnostic systems were excluded.

Interventions

The intervention considered was the implementation of ACT. The present study included trials regardless of the number of times, timing and the executors. The control group was usual care for type 2 diabetes.

Outcome measures

The primary outcomes measures were as follows:

1. HbA_{1c}

HbA_{1c} measures the number of glucose molecules bound to hemoglobin and is a percentage of the average blood glucose level over the past 2–3 months in a single blood draw. It is often used in diabetes research.

2. Self-care ability

Self-care was defined as the practice of various activities that individuals initiate and carry out on their own to maintain life and health[15]. Self-care ability was measured using the summary of diabetes self-care activities (SDSCA) at the end of trial[16]. SDSCA is a self-report instrument for measuring levels of self-management in people with diabetes. This instrument assesses seven aspects of the diabetes regimen: general diet, specific diet, exercise, medication taking, blood-glucose testing, foot care and smoking. Respondents report on the frequency of these self-management strategies over the previous 7 days (except smoking). This instrument has adequate validity and reliability.

3. All adverse events (AEs)

The definitions provided by the original study authors were followed.

Secondary outcomes were as follows:

1. Acceptance

Acceptance was defined as willingness to remain in contact with and actively experience particular private experiences[17]. Acceptance was measured using the acceptance and action diabetes question (AADQ) at the end of trial[12]. AADQ is an 11-item self-report measured on a 7-point Likert scale. The instrument measures acceptance of diabetes-related thoughts. This instrument has adequate validity and reliability.

2. Search methods for study identification

The assessment period for post-intervention HbA_{1c}, SDSCA, AEs and AADQ was within 3–6 months after the intervention, or within 3 months after the intervention if assessed at a different time point.

Electronic search

Several electronic databases were searched on 7 June 2019 to identify relevant studies. The electronic search was updated on 16 January 2021. The following databases were searched:

1. The Cochrane Central Register of Controlled Trials (CENTRAL)
2. MEDLINE (PubMed)
3. Embase (Dialog)
4. PsycINFO (PsycNET)

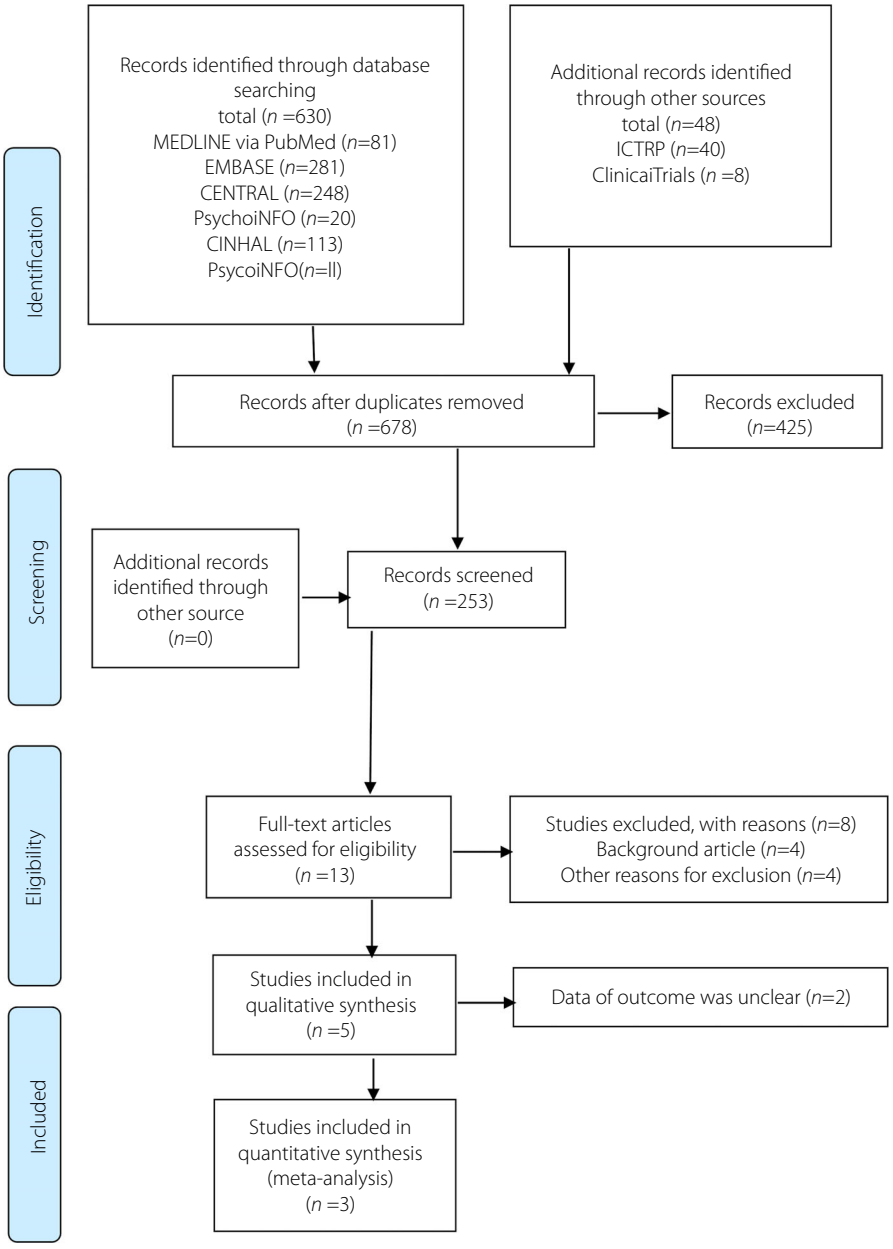

Figure 1 | Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

Searching for other resources

To identify completed, but unpublished, included trials and to investigate reporting bias, the following registries were also searched:

1. World Health Organization International Clinical Trials Registry Platform
2. ClinicalTrials.gov

The keywords searched were 'diabetes,' 'diabetes mellitus,' and 'acceptance and commitment therapy,' concatenated using Boolean operators (AND/OR; Appendix S2).

In addition, clinical guidelines and related guidelines for the treatment of diabetes, as well as references to clinical guidelines and related guidelines for the treatment of diabetes were manually searched.

Authors were contacted if the required information was not available for the studies.

Data collection

Study selection

Three of six authors (TH, RS, YM, AY, JO and YO) independently checked the titles and abstracts of articles found in the

Table 1 | Summary of findings

Outcomes	Anticipated absolute effects† (95% CI)		Relative effect (95% CI)	No. participants (studies)	Quality of the evidence (GRADE)
	Risk with control	Risk with ACT			
HbA_{1c}	Mean HbA_{1c} change ranged from 7.81 to 8.07	MD −0.62 lower (−1.07 lower to −0.16 lower)	–	232 (3 RCTs)	⊕⊕⊖⊖ LOW‡
SDSCA	Mean SDSCA change was 54.08	MD 8.48 higher (2.16 higher to 14.8 higher)	–	100 (1 RCTs)	⊕⊕⊕⊕ HIGH
Adverse events	–	–	–	–	–
AADQ	Mean AADQ change ranged from 48.43 to 76.42	MD 5.98 higher (1.42 higher to 10.54 higher)	–	231 (3 RCTs)	⊕⊕⊖⊖ LOW‡,§

AADQ, acceptance and action diabetes questionnaire; CI, confidence interval; HbA_{1c}, glycated hemoglobin; MD, mean difference; SDSCA, summary of diabetes self-care activities. †The risk in the intervention group (and its 95% confidence interval) was based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). ‡Participants were not blinded. §The intervention methods were complex.

search. Eligibility was assessed based on full text review independently. Disagreements were resolved by discussion. If necessary, another reviewer (YK) acted as an arbiter. The process is summarized in the PRISMA flow chart (Figure 1).

Data extraction and management

Data extraction was carried out according to the pre-specified form. Three of six authors (TH, RS, YM, AY, JO, and YO) extracted data independently. For studies for which sufficient information was not available, the authors were contacted. Disagreements were resolved through discussion. If necessary, another reviewer (YK) acted as an arbiter.

Assessment of the risk of bias in the included studies

Three of six authors (TH, RS, YM, AY, JO and YO) independently assessed the risk of bias in the included studies using the Cochrane Risk of Bias Tool[18]. Disagreements regarding risk of bias assessment were discussed and resolved. Domains were assessed as high risk, low risk and unclear.

Statistical analysis

Measurement of treatment effect

For continuous outcomes (HbA_{1c}, SDSCA, AADQ), mean differences (MD) and 95% confidence intervals (CIs) were calculated. AEs were summarized according to study-specific definitions, but were not pooled.

Assessment of heterogeneity

First, heterogeneity was assessed by visually inspecting the forest plot. I^2 statistics were calculated and analyzed according to the recommendations of the Cochrane Handbook (0–40%, may be insignificant; 30–60%, may show moderate heterogeneity; 50–90%, may show considerable heterogeneity; 75–100%, may show considerable heterogeneity)[19]. *P*-values of <0.10 were considered statistically significant.

Meta-analysis

The data were pooled using a random effects model. The DerSimonian and Laird method was used for random effects meta-analysis[20]. All analyses were carried out using Review Manager[21].

Certainty of evidence

The main results are presented in Table 1. Certainty of evidence was rated for each outcome pre-specified in the protocol following the grading of recommendations, assessment, development and evaluation (GRADE) approach[22].

Difference between protocol and review

The present study did not proceed with any pre-planned subgroup analysis and sensitivity analysis due to insufficient data.

RESULTS

After removing duplicates, a total of 678 records were identified. A total of 13 full-text articles were qualified and five RCTs were included in the qualitative synthesis (Appendix S3). However, just three trials were included in the meta-analysis, as the outcomes of two studies were unclear. Table 2 summarizes the published studies that were included in the quantitative synthesis. The risk of bias for the quantitative synthesis is shown in Figure 2a,b.

Primary outcome

HbA_{1c}

A meta-analysis was carried out by summarizing data from three RCTs[12,23,24] that measured HbA_{1c} (Figure 3a). The evidence suggested that ACT resulted in a reduction in HbA_{1c} (MD −0.62 points lower in the intervention group; 95% CI −1.07 to −0.16; I^2 = 0%; low-quality evidence). The standard deviation was not presented in one trial and was substituted in another trial (Table 1).

Self-care ability (SDSCA)

A meta-analysis was carried out by summarizing data from one RCT[23] that measured SDSCA (Figure 3b). ACT increased SDSCA (MD 8.48 points higher in the intervention group; 95% CI 2.16–14.80; high-quality evidence; Table 1).

Table 2 | Summary of the published studies including qualitative synthesis

Source	Setting	Patients (*n*)	Age	Inclusion criteria	Interventions	Intervention times/h
Gregg *et al.* (2007)	Clinic	81	Mean 50.9 years	English-speaking participants with type 2 diabetes receiving medical care at a low-income community health center	The workshop included the ACT manual, mindfulness and acceptance training regarding difficult thoughts and feelings about diabetes, exploration of personal values related to diabetes, and a focus on the ability to act in a valued direction while encountering difficult experiences	One time/over 4 h
Shayeghian *et al.* (2016)	Elsewhere	100	Mean 55.4 (SD 8.4) years	Age 40–60 years, T2 diabetes diagnosed within 1–10 years with no change in diabetes medication for at least 3 months before entering the study	The protocol used during the training program was based on the structure and format of the 10-session protocol contained in 'The Acceptance and Commitment Therapy for Diabetes Self-Management,' which utilizes mindfulness meditation to enhance an individual's ability to respond effectively to difficult thoughts and feelings across a variety of problems	One time/unknown
Whitehead *et al.* (2017)	Elsewhere	73	Education group Mean 53.7 (SD 8.6) years Education & ACT group Mean 56.1 (SD 6.9) years	Clinical diagnosis of type 2 diabetes for 12 months or more, age 18 years and over, with persistent, suboptimal glycemic control. This was defined as HbA_{1c} >7% 53 mmol/mol in the past 12–18 months, with at least 2 records of HbA_{1c} >7% 53 mmol/mol during this period and HbA_{1c} >7% 53 mmol/mol on recruitment	The ACT component addressed mindfulness and acceptance training in relation to difficult thoughts and feelings about diabetes, exploration of personal values related to diabetes, and a focus on the ability to act in a valued direction while encountering difficult experiences	One time/6.5 h

ACT, acceptance and commitment therapy; HbA_{1c}, glycated hemoglobin; SD, standard deviation.

AEs

AEs were not measured in all studies.

Secondary outcomes

Acceptance (AADQ)

A meta-analysis was carried out by combining data from three RCTs[12,23,24] that measured the AADQ (Figure 3c). The evidence suggested that ACT resulted in an increase in AADQ (MD 5.98 points higher in the intervention group; 95% CI 1.42–10.54; $I^2 = 43\%$; low-quality evidence; Table 1).

DISCUSSION

This is the first systematic review and meta-analysis of the use of ACT for people with type 2 diabetes. The results suggested that ACT might reduce HbA_{1c}, and increase self-care ability and acceptance of people with type 2 diabetes. However, detailed results on adverse events were not available.

The first finding of the present study was that ACT significantly reduced HbA_{1c} compared with the control (MD −0.62). A systematic review of 70 RCTs of self-management training for type 2 diabetes reported a mean reduction in HbA_{1c} of 0.19[25], whereas another systematic review of conventional CBT

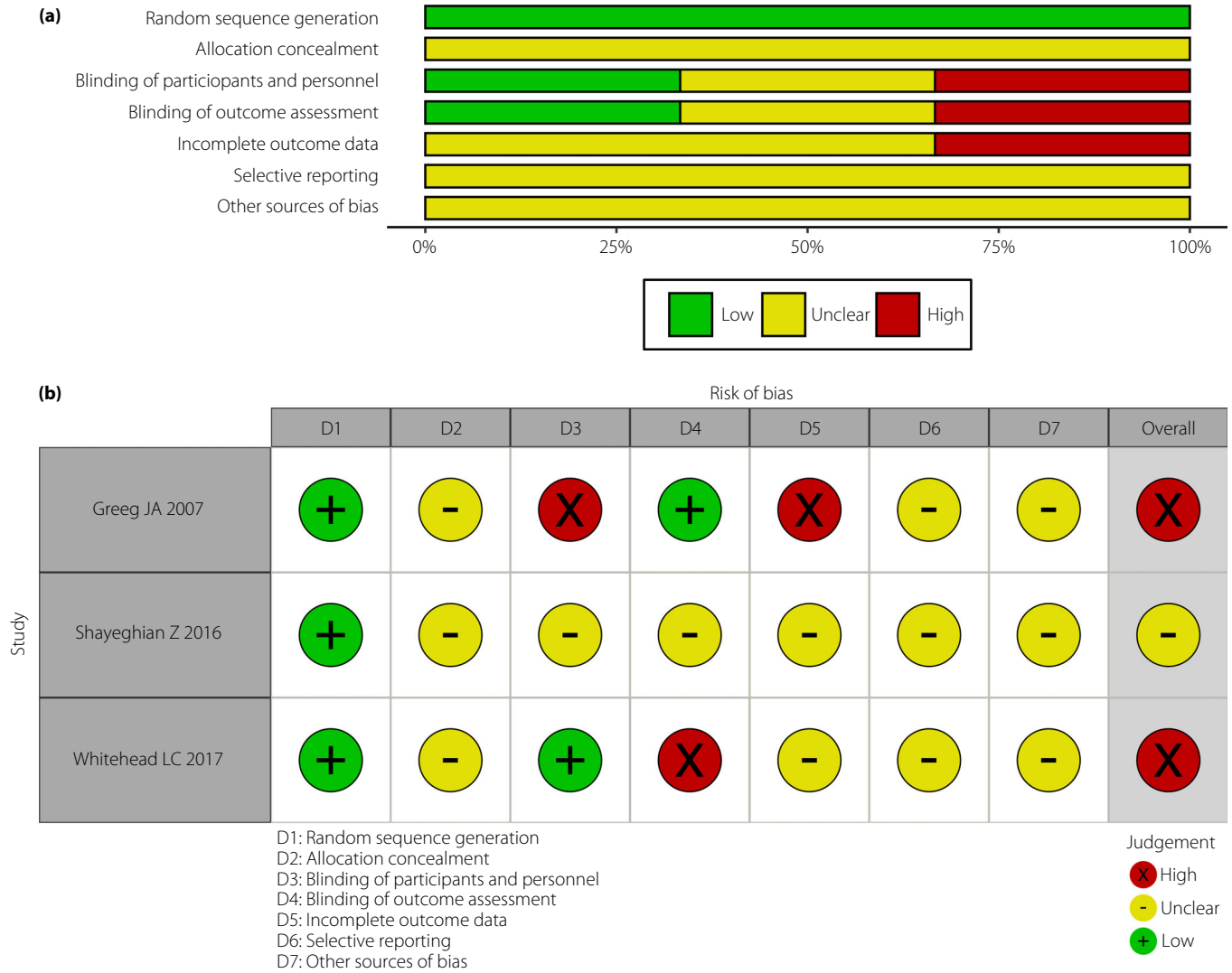

Figure 2 | (a) Risk of bias graph. (b) Risk of bias summary.

reported a mean reduction of 0.22 in HbA_{1c} (up to 4 months)[26]. In addition, a change of >0.5 on HbA_{1c} decreased major cardiovascular events[27]. Therefore, the efficacy of ACT on HbA_{1c} was considered sufficiently large.

A systematic review of exercise therapy reported a 0.67% reduction in HbA_{1c} after ≥12 weeks of exercise[28], suggesting that ACT might have an equivalent effect to this therapy.

The second finding was that ACT had an effect equivalent to increasing SDSCA scores. With the exception of one trial included in the present study, there were no trials of psychotherapy interventions for changes in SDSCA among people with type 2 diabetes. An information technology-based care management program was reported to improve SDSCA scores compared with controls in people with type 2 diabetes[29]. However, this program included 24 telephone-monitoring sessions every 2 weeks for 6 months, and once a month for the remainder of the intervention period. Compared with this program, ACT might be less burdensome for people with diabetes and healthcare providers.

The third finding was that ACT might be effective for increasing scores on the AADQ. Aside from the trials included in the present study, there were no trials of interventions to change the AADQ among people with type 2 diabetes. As a general intervention, diabetes education is important as a means of promoting acceptance and change[30]. However, a significant proportion of people with diabetes do not participate in diabetes education due to timing, cost and existing comorbidities[31]. Compared with diabetes education, ACT intervention in the included trials contained only one session. Therefore, the likelihood of participation in ACT might be higher compared with diabetes education.

The reviewed trials did not report any AEs, although AEs were one of the primary outcomes found in the meta-analysis.

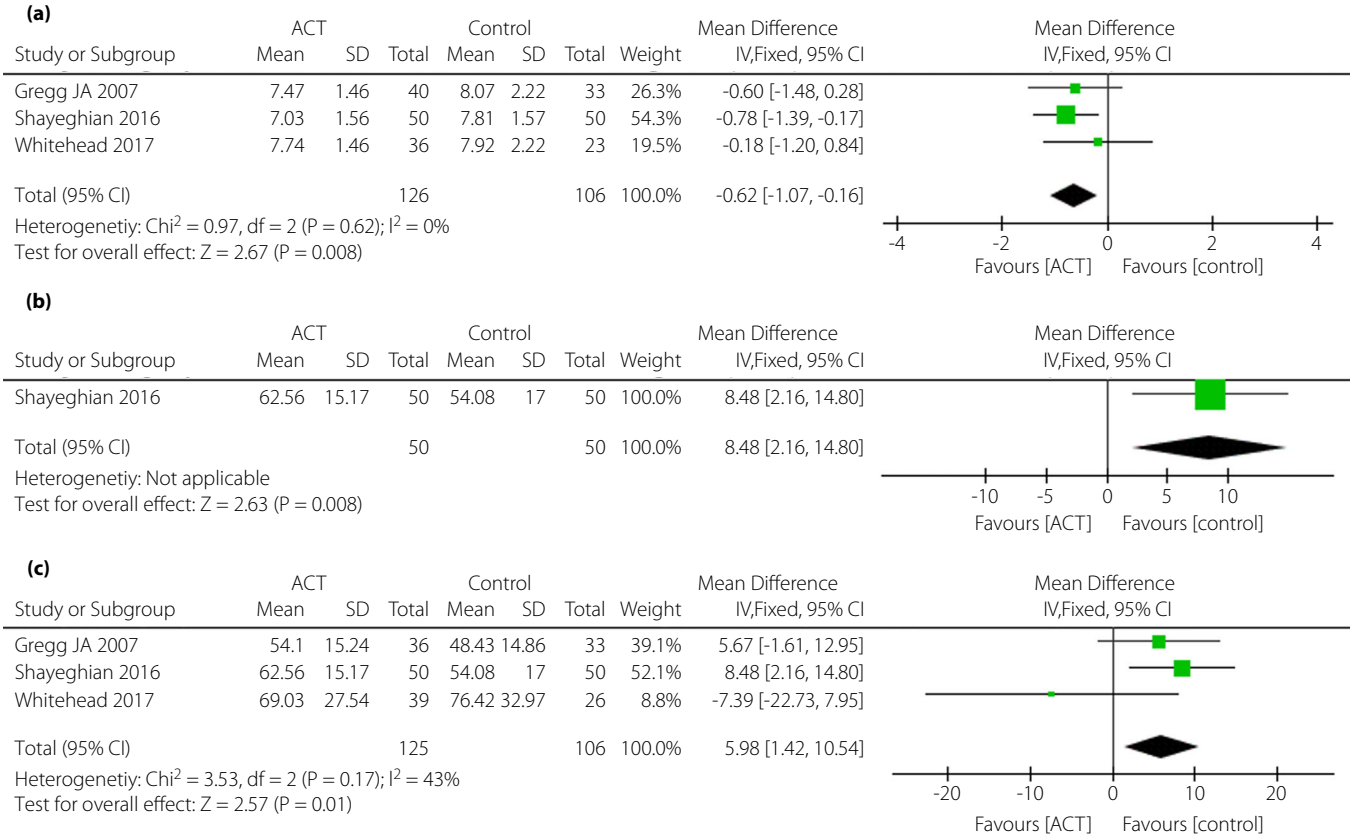

Figure 3 | (a) Forest plot of comparison: glycated hemoglobin. (b) Forest plot of comparison: summary of diabetes self-care activities score. (c) Forest plot of comparison: acceptance and action diabetes question score.

Detailed reporting of AEs occurring in clinical trials is necessary to provide all stakeholders with useful and comprehensive information on safety profiles. Therefore, future trials should be carried out with a view to thoroughly investigate AEs.

This study presented the first systematic review of RCTs that have carried out ACTs for people with diabetes. In addition, this was the first systematic review using the AADQ as an acceptance scale.

The present study had some limitations. First, most of the trials extracted through the systematic review had a small sample size. In addition, the extracted papers had a low quality of evidence. Studies with high quality of designs and large sample sizes are warranted in the future. Second, although the search was carried out to detect studies in any language, only English databases were utilized. Databases in other countries and in languages other than English were beyond the scope of the present study. Third, this study assessed the short-term efficacy of ACT. Therefore, long-term efficacy of ACT should be assessed in future studies. Finally, as this study focused on type 2 diabetes, the results cannot be generalized to type 1 diabetes.

In conclusion, the findings suggest that ACT might reduce HbA_{1c}, improve self-care ability and enhance acceptance among people with type 2 diabetes.

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DISCLOSURE

The authors declare no conflict of interest.
Approval of the research protocol: N/A.
Informed Consent: N/A.
Approval date of Registry and the Registration No. of the study/trial: The protocol has been registered in R000042173 of the UMIN CTR. The research information disclosure date was 1 July 2019.
Animal Studies: N/A.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1 | Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 checklist.

Appendix S2 | Search strategy.

Appendix S3 | Reasons for exclusion from eight studies.