Published in final edited form as:

Obes Rev. 2016 August ; 17(8): 758–769. doi:10.1111/obr.12423.

A systematic review of commercial weight-loss programs' effect on glycemic outcomes among adults with or at increased risk for type 2 diabetes mellitus

Zoobia W. Chaudhry¹, Ruchi S. Doshi¹, Ambereen K. Mehta², David K. Jacobs³, Rachit M. Vakil^{4,5}, Clare J. Lee¹, Sara N. Bleich⁴, Rita R. Kalyani¹, Jeanne M. Clark^{1,4,6}, and Kimberly A. Gudzone^{1,6}

¹The Johns Hopkins University School of Medicine; Baltimore, MD

²The Johns Hopkins Bayview Medical Center; Baltimore, MD

³The University of Maryland School of Medicine; Baltimore, MD

⁴The Johns Hopkins Bloomberg School of Public Health; Baltimore, MD

⁵Rutgers Robert Wood Johnson Medical School; Piscataway, NJ

⁶The Welch Center for Prevention, Epidemiology, Prevention, and Clinical Research; Baltimore, MD

Abstract

Objective—We examined the glycemic benefits of commercial weight-loss programs as compared to control/education or counseling among overweight and obese adults who had or who were at increased risk for type 2 diabetes mellitus (T2DM).

Methods—We searched MEDLINE, Cochrane Database of Systematic Reviews, and references cited by individual programs. We included randomized controlled trials (RCTs) of 12 weeks duration. Two reviewers extracted information on study design, population characteristics, interventions, and mean changes in hemoglobin A1c and glucose.

Results—We included 18 RCTs. Few trials occurred among individuals with T2DM. In this population, Jenny Craig reduced A1c at least 0.4% more than counseling at 12 months, Nutrisystem significantly reduced A1c 0.3% more than counseling at 6 months, and OPTIFAST reduced A1c 0.3% more than counseling at 6 months. Among individuals at increased risk for T2DM, few studies evaluated glycemic outcomes, and when reported, most did not show substantial reductions.

Discussion—Few trials have examined whether commercial weight-loss programs result in glycemic benefits for their participants, particularly among individuals at increased risk of T2DM. Jenny Craig, Nutrisystem, and OPTIFAST show promising glycemic lowering benefits for patients with T2DM, although additional studies are needed to confirm these conclusions.

Corresponding and Reprint Author: Zoobia W. Chaudhry, M.D., Division of General Internal Medicine, The Johns Hopkins University School of Medicine, 933 N. Wolfe Street, Baltimore, Maryland 21205 USA, Phone: 410-955-3250; zchaudh2@jhmi.edu.

Disclosures: The authors have no relevant conflicts of interest to disclose.

Keywords

Commercial Weight Loss; Hemoglobin A1c; Glucose; Type 2 Diabetes Mellitus

Introduction

The Centers for Disease Control (CDC) has estimated that 29.1 million U.S. adults have type 2 diabetes mellitus (T2DM), of which 8.1 million remain undiagnosed (1). The increasing prevalence of obesity has coincided with an increase in the T2DM prevalence (2) and growing costs of T2DM management (3). Two-thirds of U.S. adults are overweight or obese (4), placing them at increased risk for developing T2DM (5-6).

The Diabetes Prevention Program (DPP) trial demonstrated that overweight/obese adults with pre-diabetes who lost at least 2.5 kg at 2 years through lifestyle intervention significantly reduced their risk of developing T2DM (7). In the Action for Health in Diabetes (Look AHEAD) trial, adults with T2DM who lost weight through lifestyle intervention had greater improvements in hemoglobin A1c and reduced need for diabetes medications than controls (8). DPP and Look AHEAD demonstrate the glycemic benefits of weight loss, although attaining similar results in the community could be more challenging given that patients tend to be less activated than individuals willing to participate in a clinical trial. In addition, both DPP and Look AHEAD used intensive lifestyle interventions, which may not be readily available to many patients in the community (9).

In contrast, commercial weight-loss programs are common across the U.S. and other countries. Clinicians might be considering referrals to these programs as a substitute. Our previous review found that Weight Watchers and Jenny Craig decreased weight significantly more than control/education or counseling at 12 months, and that other programs had modest to no greater weight loss than comparator (10). While weight loss is a strong driver of glycemic improvement (7–8), it is critical to verify that commercial programs achieve the anticipated glycemic benefits – particularly if clinicians are considering referral to these programs. In addition, these programs vary with respect to their intensity and their encouraged lifestyle changes, which may deviate substantially from DPP and Look AHEAD. Therefore, the glycemic changes might not follow expected patterns. For example, participants on a weight-maintaining, low-carbohydrate diet have greater reductions in hemoglobin A1c than those on a low-fat diet (11). Overall, knowing whether these programs also result in similar improvements in glycemic control to DPP or Look AHEAD may justify broader recommendation and use of commercial weight-loss programs.

Prior systematic reviews have only examined the efficacy of commercial programs for weight loss (10,12), and none have examined the effect of these programs on glycemic outcomes such as hemoglobin A1c or glucose. Our objective was to examine the glycemic benefits of commercial or proprietary weight-loss programs as compared to control/education or counseling among overweight/obese individuals who have or are at increased risk for T2DM.

Methods

Identification and Selection of Weight-Loss Programs

We generated a list of 141 commercial and proprietary weight-loss programs through several sources: obesity experts, U.S. News and World Report rankings, and Internet searches. We included 32 commercial or proprietary programs available in the U.S. that emphasized nutrition and behavioral counseling/social support components with or without physical activity (Supplemental Table 1). Details on the program selection have been previously described (10).

Protocol and Registration

We developed a study protocol based on the 2005 systematic review (12) and made it publicly available online on PROSPERO (CRD42014007155). We have previously described our methods in detail (10) in an article presenting our primary outcome of mean percentage weight change. We established hemoglobin A1c and glucose as secondary outcomes a priori.

Data Sources and Search Strategy

We used three data sources to identify citations: MEDLINE, Cochrane Database of Systematic Reviews (CDSR), and the commercial or proprietary weight-loss programs themselves. Our search strategy has been published previously (10). We searched MEDLINE for articles published from October 2002 through November 2014. We screened all articles included in the prior review (12), which searched MEDLINE from inception through October 2003. We searched CDSR from inception to November 2014 using a similar search strategy as our MEDLINE search. We contacted all included programs to request bibliographies of published studies and unpublished data using their program and reviewed their websites for citations.

Study Selection

Two study team members independently reviewed and screened articles against pre-specified eligibility criteria (Supplemental Table 2). We included RCTs among adults with or at increased risk for T2DM that compared a commercial or propriety weight-loss program to control/education or counseling. Comparators were defined as “control/education” if participants received no intervention, only printed materials, health education curriculum, or engaged in less than 3 sessions with a provider during the study period and as “counseling” if participants had 3 or more consultations with a provider during the intervention. To be included, RCTs needed to be 12 weeks duration or greater. Given that the American Diabetes Association (ADA) and American Heart Association (AHA) have identified overweight/obesity as a critical risk factor for T2DM (5–6,13), we defined “at increased risk of T2DM” to be adults with overweight/obesity.

Data Extraction and Risk of Bias Assessment

Two team members extracted data on study design, setting, population characteristics, and intervention characteristics. In this article, our primary outcomes included mean changes in

hemoglobin A1c and fasting glucose. Our secondary outcome was change in diabetes medications among individuals with T2DM. We have previously reported weight loss, adherence, and adverse event outcomes from these same studies, and therefore, do not report them here (10).

Two reviewers independently assessed the risk of bias (ROB) for each included study using the Cochrane Collaboration's tool (14). We rated a trial's overall ROB at a time point by examining the following domains: selection bias based on inadequate generation of a randomized sequence, detection bias based on lack of outcome assessor blinding, and attrition bias. We designated a trial as "low" ROB if all domains were low; as "unclear" if all domains were unclear; as "high" if any domain was high; and otherwise were considered "moderate." We characterized the ROB for each program's body of evidence by examining the overall ROB for relevant trials. For each program, we rated the ROB across trials as "low" if most studies were low; as "high" if most trials were high; and otherwise as "moderate."

Data Synthesis and Analysis

For all comparisons, we calculated and display the between-group mean differences with 95% CIs, if calculable, for individual RCTs grouped by comparison. We report outcomes separately for individuals with T2DM and those at increased risk of T2DM, as differing results would be expected for glycemic outcomes for these two populations. We did not perform meta-analyses given the trials' heterogeneous study populations, variable comparator arms, varying analysis types, and failure to report variance estimates for difference-in-differences.

Results

Of the 4,212 citations evaluated, we included 18 trials reported in 32 articles or unpublished reports (Figure 1) on 9 programs out of the 32 eligible. Supplemental Table 3 provides details on study and population characteristics, attrition and ROB ratings for all trials.

Studies among Individuals with T2DM

In studies of individuals with T2DM, mean age ranged from 52 to 59 years, most were female, and BMI ranged from 32 to 39 kg/m² (Table 1).

Market Leading Programs: Weight Watchers, Jenny Craig, and Nutrisystem—

One RCT compared traditional and low-carbohydrate versions of Jenny Craig to counseling (15). Jenny Craig participants reduced A1c by 0.4% to 0.8% greater than counseling at 12 months (Figure 2)(ROB: high). Insulin was reduced/stopped in 8% of counseling participants as compared to 63% of traditional Jenny Craig and 90% of low-carbohydrate Jenny Craig participants (Table 3). Oral hypoglycemic medications were decreased/stopped in 16% of counseling, 39% of traditional Jenny Craig, and 32% of low-carbohydrate Jenny Craig participants at 12 months (Table 3). The trial only provided pooled variance estimates for the intervention arms when reporting between-group differences for A1c, glucose and

medication changes (which were all statistically significant); therefore, we cannot report statistical significance for the individual comparisons.

Two RCTs examined Nutrisystem in patients with T2DM – one compared the intervention to control/education (16) and the other to counseling (17). Neither trial examined outcomes at 12 months. Relative to comparators, Nutrisystem resulted in significantly greater short-term reductions in A1c (Figure 2)(ROB: moderate). As compared to counseling, Nutrisystem significantly reduced use of hypoglycemic medications (Table 3).

We identified no trials of Weight Watchers among patients with T2DM.

Intensive Very-Low-Calorie or Low-Calorie Meal Replacement Programs: Health Management Resources (HMR) and OPTIFAST—One RCT compared OPTIFAST to counseling (18), which only reported completers' analyses. At 6 months, OPTIFAST reduced A1c 0.3% more than counseling (ROB: high)(Figure 2). The trial did not report variance estimates for between-group differences, thus we cannot report statistical significance.

We identified no trials of HMR among patients with T2DM that met our inclusion criteria.

Self-Directed and Other Programs: SlimFast, Atkins, The Biggest Loser Club, and Curves—Two RCTs compared SlimFast to counseling (19–20), which only reported completers' analyses. One trial reported outcomes at 12 months (19), and there was no significant difference in A1c change between SlimFast and counseling at this time point (Figure 2)(ROB: high). SlimFast participants had greater reductions oral hypoglycemic agents as compared to counseling (Table 3).

Two RCTs compared Atkins to counseling (21–24), one of which only reported completers' analyses (22–24). There were no significant differences in A1c between Atkins and counseling at any time point (Figure 2)(ROB: high).

We identified no trials of The Biggest Loser Club or Curves among patients with T2DM.

Studies with Individuals at Increased Risk of T2DM

In studies of individuals at increased risk of T2DM, mean age ranged from 39 to 54 years, most were female, and BMI ranged from 31–37 kg/m² (Table 2). The reported mean glucose values were not typically in the pre-diabetes range (5.6 to 6.9 mmol/L).

Market Leading Programs: Weight Watchers, Jenny Craig, and Nutrisystem—Three RCTs compared Weight Watchers to control/education (25–30). Weight Watchers significantly lowered glucose at 6 months compared to control/education in one trial (29–30), but no significant between-group differences existed in mean glucose change at 12 months (Figure 3)(ROB: high).

We identified no trials of Jenny Craig or Nutrisystem in patients at increased risk of T2DM that met our inclusion criteria.

Intensive Very-Low-Calorie or Low-Calorie Meal Replacement Programs: HMR and OPTIFAST—One RCT compared a low-calorie version of HMR to counseling (31). No trials continued to 12 months. At 6 months, HMR significantly reduced fasting glucose 0.58 mmol/L more than counseling (ROB: high)(Figure 4).

We identified no trials of OPTIFAST in patients at increased risk of T2DM that met our inclusion criteria.

Self-Directed and Other Programs: SlimFast, Atkins, Biggest Loser Club, and Curves—Three RCTs compared SlimFast to control/education (29–30,32–37) – two only reported completers' analyses. Results were mixed comparing SlimFast and control with respect to fasting glucose – no consistent effects could be ascertained (Figure 4)(ROB: high).

Four RCTs examined glycemic outcomes among Atkins participants – one compared to control/education (29–30) and three to behavioral counseling (22–24,38–40). At 12 months, no difference in mean glucose change occurred between Atkins and counseling (Figure 4) (ROB: Moderate).

One RCT evaluated The Biggest Loser Club (41–43). At 3 months, no significant difference existed in change in fasting glucose between The Biggest Loser Club and control/education (Figure 4)(ROB: low).

One unpublished RCT evaluated Curves (44–46) as compared to control/education. Curves did not result in a significantly greater decrease in percent change in fasting glucose as compared to control/education (0.6% versus 1.3%, respectively; $p=0.85$) (ROB: unclear).

Discussion

For overweight/obese adults with T2DM, the 2016 American Diabetes Association (ADA) guidelines recommend that these individuals lose weight through lifestyle changes (47). Modest weight loss may provide clinical benefits in some individuals with T2DM, especially those early in the disease process (48). Similarly, the Community Preventive Services Task Force has recommended the use of combined diet and physical activity counseling for overweight patients at increased risk for T2DM (49). Despite the evidence and recommendations, there are limited options in the community that offer intensive lifestyle interventions as studied in DPP (16 counseling sessions and >150 minutes/week of physical activity)(7) or Look AHEAD (calorie restriction, meal replacement, counseling and >150 minutes/week of physical activity)(8). Thus, clinicians may consider commercial weight-loss programs as a substitute given their ready availability. Commercial weight-loss programs are popular and represent a multi-billion dollar industry (50). This review is the first to examine the evidence regarding the efficacy of commercial weight-loss programs on glycemic outcomes among patients with and at increased risk for T2DM.

Three programs showed promising glycemic lowering benefits among patients with T2DM. In a single trial, Jenny Craig resulted in greater reductions in A1c at 12 months when compared to counseling. This study also reported greater reductions in diabetes medications, which suggests Jenny Craig's beneficial effects beyond changes in A1c. Other trials

reporting 12-month outcomes, which examined SlimFast and Atkins, did not show significant A1c reductions. Nutrisystem and OPTIFAST showed promising short-term A1c reductions relative to comparators. Given that the goal of many patients and clinicians is sustained weight loss and glycemic improvement, additional trials that extend to 12 months or beyond are needed to confirm the findings for these programs. We did not find eligible RCTs for any other popular commercial programs among individuals with T2DM. Based on available evidence, Jenny Craig, Nutrisystem, and OPTIFAST appear most promising among patients with T2DM, although clinicians should be aware of the moderate to high risk of bias for these trials. If considering patient referral, clinicians should also be aware that these programs might have higher costs than Weight Watchers or self-directed programs (10). These commercial programs may be considered among the nutritional treatment options with evidence to support glycemic benefits, which also include Mediterranean (51) and vegan diets (52).

We also examined benefits among patients at increased risk for T2DM. While Weight Watchers and Jenny Craig consistently led to greater reductions in weight as compared to control/education or counseling (10), there were no long-term differences between Weight Watchers and control/education in fasting glucose and no trials of Jenny Craig reported glycemic outcomes among patients at increased risk for T2DM. When compared to control/education or counseling, one trial showed that HMR achieved a significantly greater short-term change in fasting glucose as compared to counseling. Atkins had similar effects on glucose change to counseling and no consistent effects were seen with SlimFast relative to comparator. Little evidence exists for The Biggest Loser Club and Curves, and no evidence exists for Jenny Craig, Nutrisystem or OPTIFAST. Overall, the quality of evidence evaluating the efficacy of commercial weight-loss programs on glycemic outcomes among individuals at increased risk for T2DM is poor, and we can draw no firm conclusions. Clinicians and patients should be aware that it is unclear whether the previously described weight loss benefits translate into reductions in fasting glucose. Additional studies are needed among individuals at increased risk for T2DM to determine whether or not any benefits exist – including overweight/obese individuals with pre-diabetes as the study population would enable a better comparison with that which was enrolled in DPP. At this time, referral to an organization offering the National Diabetes Prevention Program for weight loss, may be a better evidence-based option for individuals with pre-diabetes (53).

Reducing the costs associated with T2DM and obesity are critical. In 2012, the management of T2DM was associated with \$245 billion of direct and indirect costs (1), and the costs of obesity and its associated conditions were estimated to be \$147 billion (3). To address these rising costs, the 2010 Patient Protection and Affordable Care Act mandated the provision of diagnosis and referral of patients with obesity for weight management. While our results suggest that several commercial weight-loss programs have promising glycemic benefits for patients with T2DM (Jenny Craig, Nutrisystem, OPTIFAST), these programs are often not covered benefits and their associated fees may be barriers for some patients. Whether more health insurers will consider expanding benefits coverage or offer incentives for participation in these programs is unclear.

Our systematic review is limited by the paucity of long-term trials evaluating glycemic outcomes among commercial weight-loss programs. Given the short duration of many trials, we are unable to comment on benefits with respect to reduction in incidence of T2DM among those patients at increased risk. We defined the population at increased risk of T2DM as those individuals with overweight/obesity, and were not able to distinguish the prevalence of other important risk factors for T2DM, like pre-diabetes, in these groups. Future studies should consider including individuals with overweight/obesity and pre-diabetes in studies of commercial weight-loss programs to be more comparable with DPP. Given that the average fasting glucose was normal for most trials among participants at increased risk for T2DM, the ability to detect programs' effect on this outcome might be diminished. In contrast, more robust decreases in fasting glucose and A1c were seen among individuals with T2DM. Only 4 RCTs reported changes in medication use among patients with T2DM, which may be a critically important outcome to patients and clinicians. Other limitations of the review have been discussed previously (10) and include the following: 1) we only included commercial weight-loss programs available across the U.S.; 2) risk of bias was high for many trials and many were funded by the programs themselves, which may influence interpretations of intervention effect; and 3) internal validity of many trials was weak due to high attrition and less robust statistical methods (e.g., completers' only analyses as compared to intention-to-treat with baseline observation carried forward approach).

Conclusion

Among individuals with T2DM, Jenny Craig reduced A1c more than counseling at 12 months and Nutrisystem and OPTIFAST showed promising short-term A1c results. Among individuals at increased risk for T2DM, the paucity of evidence limits our ability to draw conclusions and emphasizes the need for additional research in this area. Some commercial programs might be considered as treatment options in addition to others like the CDC-certified National Diabetes Prevention Programs. Clinicians should consider discussing individual programs' outcomes and costs with patients to determine the best weight management plan.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding Sources:

This study had no direct funding support. RSD was supported by the Johns Hopkins medical student summer research program and the Johns Hopkins Institute for Clinical and Translational Research (ICTR), which is funded in part by Grant Number TL1TR001078 from the National Center for Advancing Translational Sciences (NCATS). DKJ was supported by the Medical Student Research Program in Diabetes at JHU-UMD Diabetes Research Center from NIDDK (P30DK079637). SNB and KAG were supported by career development awards from the NHLBI (K01HL096409 and K23HL116601, respectively). RRR was supported by a career development award from NIDDK (DK093583). The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official view of the Johns Hopkins ICTR, NCATS or NIH.

References

1. Centers for Disease Control and Prevention. National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014. Atlanta, GA: U.S. Department of Health and Human Services; 2014.
2. Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS, Marks JS. Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk Factors, 2001. *JAMA*. 2003; 289:76–9. [PubMed: 12503980]
3. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W. Annual Medical Spending Attributable To Obesity: Payer-And Service-Specific Estimates. *Health Aff (Millwood)*. 2009; 28:w822–31. [PubMed: 19635784]
4. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA*. 2014; 311:806–14. [PubMed: 24570244]
5. Colditz GA, Willett WC, Rotnitzky A, Manson JE. Weight gain as a risk factor for clinical diabetes mellitus in women. *Ann Intern Med*. 1995; 122:481–6. [PubMed: 7872581]
6. Helmrich SP, Ragland DR, Leung RW, Paffenbarger RS Jr. Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. *N Engl J Med*. 1991; 325:147–52. [PubMed: 2052059]
7. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002; 346:393–403. [PubMed: 11832527]
8. Look AHEAD Research Group. Long-term Effects of a Lifestyle Intervention on Weight and Cardiovascular Risk Factors in Individuals With Type 2 Diabetes Mellitus: Four-Year Results of the Look AHEAD Trial. *Arch Intern Med*. 2010; 170:1566–75. [PubMed: 20876408]
9. Bloom B, Mehta AK, Clark JM, Gudzone KA. Guideline-concordant weight-loss programs in an urban area are uncommon and difficult to identify through the Internet. *Obesity (Silver Spring)*. 2015 (in press).
10. Gudzone KA, Doshi RS, Mehta AK, et al. Efficacy of Commercial Weight-Loss Programs: An Updated Systematic Review. *Ann Intern Med*. 2015; 162:501–512. [PubMed: 25844997]
11. Gannon MC, Nuttall FQ. Effect of a high-protein, low-carbohydrate diet on blood glucose control in people with type 2 diabetes. *Diabetes*. 2004; 53:2375–82. [PubMed: 15331548]
12. Tsai AG, Wadden TA. Systematic Review: An Evaluation of Major Commercial Weight Loss Programs in the United States. *Ann Intern Med*. 2005; 142:56–66. [PubMed: 15630109]
13. Eckel RH, Kahn R, Robertson RM, Rizza RA. Preventing cardiovascular disease and diabetes: a call to action from the American Diabetes Association and the American Heart Association. *Circulation*. 2006; 113:2943–6. [PubMed: 16801475]
14. Higgins, JPT., Green, S., editors. *Cochrane Handbook for Systematic Reviews of Interventions*, Version 5.1.0. The Cochrane Collaboration; 2011. Accessed at <http://www.cochrane-handbook.org> [on 1 October 2013]
15. Rock CL, Flatt SW, Pakiz B, et al. Weight loss, glycemic control, and cardiovascular disease risk factors in response to differential diet composition in a weight loss program in type 2 diabetes: a randomized controlled trial. *Diabetes Care*. 2014; 37:1573–80. [PubMed: 24760261]
16. Foster GD, Borradaile KE, Vander Veur SS, et al. The effects of a commercially available weight loss program among obese patients with type 2 diabetes: a randomized study. *Postgrad Med*. 2009; 121:113–8.
17. Foster GD, Wadden TA, Lagrotte CA, et al. A randomized comparison of a commercially available portion-controlled weight-loss intervention with a diabetes self-management education program. *Nutr Diabetes*. 2013; 3:e63. [PubMed: 23507967]
18. Wing RR, Blair E, Marcus M, Epstein LH, Harvey J. Year-long weight loss treatment for obese patients with type II diabetes: does including an intermittent very-low-calorie diet improve outcome? *Am J Med*. 1994; 97:354–62. [PubMed: 7942937]
19. Li Z, Go VL, DeShields S, et al. Long-term efficacy of soy-based meal replacements vs an individualized diet plan in obese type II DM patients: relative effects on weight loss, metabolic parameters, and C-reactive protein. *Eur J Clin Nutr*. 2005; 59:411–8. [PubMed: 15674301]
20. Yip I, Go VL, DeShields S, et al. Liquid meal replacements and glycemic control in obese type 2 diabetes patients. *Obes Res*. 2001; 9(Suppl4):S341–7.

21. Davis NJ, Tomuta N, Schechter C, et al. Comparative study of the effects of a 1-year dietary intervention of a low-carbohydrate diet versus a low-fat diet on weight and glycemic control in type 2 diabetes. *Diabetes Care*. 2009; 32:1147–52. [PubMed: 19366978]
22. Shai I, Schwarzfuchs D, Henkin Y, et al. Dietary Intervention Randomized Controlled Trial (DIRECT) Group. Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet. *N Engl J Med*. 2008; 359:229–41. [PubMed: 18635428]
23. Greenberg I, Stampfer MJ, Schwarzfuchs D, Shai I. DIRECT Group. Adherence and success in long-term weight loss diets: the Dietary Intervention Randomized Controlled Trial (DIRECT). *J Am Coll Nutr*. 2009; 28:159–68. [PubMed: 19828901]
24. Tirosh A, Golan R, Harman-Boehm I, et al. Renal function following three distinct weight loss dietary strategies during 2 years of a randomized controlled trial. *Diabetes Care*. 2013; 36:2225–32. [PubMed: 23690533]
25. Heshka S, Greenway F, Anderson JW, et al. Self-help weight loss versus a structured commercial program after 26 weeks: a randomized controlled study. *Am J Med*. 2000; 109:282–7. [PubMed: 10996578]
26. Heshka S, Anderson JW, Atkinson RL, et al. Weight loss with self-help compared with a structured commercial program: a randomized trial. *JAMA*. 2003; 289:1792–8. [PubMed: 12684357]
27. Jebb SA, Ahern AL, Olson AD, et al. Primary care referral to a commercial provider for weight loss treatment versus standard care: a randomised controlled trial. *Lancet*. 2011; 378:1485–92. [PubMed: 21906798]
28. Walker CG, Holzapfel C, Loos RJ, et al. Genetic predisposition to an adverse lipid profile limits the improvement in total cholesterol in response to weight loss. *Obesity (Silver Spring)*. 2013; 21:2589–95. [PubMed: 23418103]
29. Truby H, Baic S, deLooy A, et al. Randomised controlled trial of four commercial weight loss programmes in the UK: initial findings from the BBC “Diet Trials”. *BMJ*. 2006; 332:1309–14. [PubMed: 16720619]
30. Morgan LM, Griffin BA, Millward DJ, et al. Comparison of the effects of four commercially available weight-loss programmes on lipid-based cardiovascular risk factors. *Public Health Nutr*. 2009; 12:799–807. [PubMed: 18647427]
31. Anderson JW, Reynolds R, Bush HM, Rinsky JL, Washnock C. Effect of a behavioral/nutritional intervention program on weight loss in obese adults: a randomized controlled trial. *Postgrad Med*. 2011; 123:205–13. [PubMed: 21904103]
32. Ditschuneit HH, Flechtner-Mors M, Johnson TD, Adler G. Metabolic and weight-loss effects of a long-term dietary intervention in obese patients. *Am J Clin Nutr*. 1999; 69:198–204. [PubMed: 9989680]
33. Flechtner-Mors M, Ditschuneit HH, Johnson TD, Suchard MA, Adler G. Metabolic and weight loss effects of long-term dietary intervention in obese patients: four-year results. *Obes Res*. 2000; 8:399–402. [PubMed: 10968732]
34. Ditschuneit HH, Flechtner-Mors M. Value of structured meals for weight management: risk factors and long-term weight maintenance. *Obes Res*. 2001; 9(Suppl4):S284–9.
35. Ditschuneit HH, Frier HI, Flechtner-Mors M. Lipoprotein responses to weight loss and weight maintenance in high-risk obese subjects. *Eur J Clin Nutr*. 2002; 56:264–70. [PubMed: 11960302]
36. Noakes M, Foster PR, Keogh JB, Clifton PM. Meal replacements are as effective as structured weight-loss diets for treating obesity in adults with features of metabolic syndrome. *J Nutr*. 2004; 134:1894–9. [PubMed: 15284372]
37. Clifton PM, Keogh JB, Foster PR, Noakes M. Effect of weight loss on inflammatory and endothelial markers and FMD using two low-fat diets. *Int J Obes (Lond)*. 2005; 29:1445–51. [PubMed: 16172619]
38. Gardner CD, Kiazand A, Alhassan S, et al. Comparison of the Atkins, Zone, Ornish, and LEARN diets for change in weight and related risk factors among overweight pre-menopausal women: the A TO Z Weight Loss Study: a randomized trial. *JAMA*. 2007; 297:969–77. [PubMed: 17341711]
39. Moore SD, King AC, Kiernan M, Gardner CD. Outcome expectations and realizations as predictors of weight regain among dieters. *Eat Behav*. 2011; 12:60–3. [PubMed: 21184975]

40. McAuley KA, Hopkins CM, Smith KJ, et al. Comparison of high-fat and high-protein diets with a high-carbohydrate diet in insulin-resistant obese women. *Diabetologia*. 2005; 48:8–16. [PubMed: 15616799]
41. Collins CE, Morgan PJ, Jones P, et al. Evaluation of a commercial web-based weight loss and weight loss maintenance program in overweight and obese adults: a randomized controlled trial. *BMC Public Health*. 2010; 10:669. [PubMed: 21047432]
42. Collins CE, Morgan PJ, Jones P, et al. A 12-week commercial web-based weight-loss program for overweight and obese adults: randomized controlled trial comparing basic versus enhanced features. *J Med Internet Res*. 2012; 14:e57. [PubMed: 22555246]
43. Hutchesson MJ, Collins CE, Morgan PJ, Watson JF, Guest M, Callister R. Changes to dietary intake during a 12-week commercial web-based weight loss program: a randomized controlled trial. *Eur J Clin Nutr*. 2014; 68:64–70. [PubMed: 24129359]
44. Levers, K., Baetge, C., Lockard, B., et al. [on 10 November 2014] Effects of Exercise and Diet-Induced Weight Loss on Markers of Inflammation: Impact on Body Composition and Markers of Health and Fitness. Accessed at <http://exerciseandsportnutritionlab.com/Portals/70/2013%20ISSN%20Posters.pdf>
45. Jung, YP., Lockard, B., Baetge, C., et al. [on 10 November 2014] Adherence to a high protein and low fat energy-restricted diet while participating in a circuit resistance-exercise program promotes fat loss with no loss in fat free mass in post-menopausal women. Accessed at <http://exerciseandsportnutritionlab.com/Portals/70/2013%20FASEB%20Posters.pdf>
46. Jagim, A., Byrd, M., Lockard, B., et al. [on 10 November 2014] Adherence to a high protein and low fat energy-restricted diet while participating in a circuit resistance-exercise program promotes positive changes in blood glucose and lipids in post-menopausal women. Accessed at <http://exerciseandsportnutritionlab.com/Portals/70/2013%20FASEB%20Posters.pdf>
47. American Diabetes Association. Obesity management for the treatment of type 2 diabetes. *Diabetes Care*. 2016; 39(Suppl1):S47–51. [PubMed: 26696681]
48. Look AHEAD Research Group. Reduction in weight and cardiovascular disease risk factors in individuals with type 2 diabetes: one-year results of the Look AHEAD trial. *Diabetes Care*. 2007; 30:1374–83. [PubMed: 17363746]
49. Pronk NP, Remington PL. Combined Diet and Physical Activity Promotion Programs for Prevention of Diabetes: Community Preventive Services Task Force Recommendation Statement. *Ann Intern Med*. 2015; 163:465–8. [PubMed: 26168073]
50. IBISWorld. Weight loss services in the US industry market re- search report; June 2014. Los Angeles: IBISWorld; 2014. Accessed at <http://clients1.ibisworld.com/reports/us/industry/default.aspx?entid=1719> [on 25 August 2014]
51. Esposito K, Maiorino MI, Ciotola M, et al. Effects of a Mediterranean-Style Diet on the Need for Antihyperglycemic Drug Therapy in Patients With Newly Diagnosed Type 2 Diabetes: A Randomized Trial. *Ann Intern Med*. 2009; 151:306–14. [PubMed: 19721018]
52. Turner-McGrievy GM, Barnard ND, Cohen J, Jenkins DJA, Gloede L, Green AA. Changes in nutrient intake and dietary quality among participants with type 2 diabetes following a low- fat vegan diet or a conventional diabetes diet for 22 weeks. *J Am Diet Assoc*. 2008; 108:1636–45. [PubMed: 18926128]
53. [on 21 July 2015] National Diabetes Prevention Program. Accessed at <http://www.cdc.gov/diabetes/prevention/recognition/index.htm>

Figure 1.

Summary of evidence search and selection. *Other exclusions included trials with ineligible study designs (retrospective case series, RCT<12 weeks duration, etc) or ineligible programs (not available in the US, etc). **Ineligible commercial programs include those that use medications or supplements, modified specifically for the study, unavailable in the U.S., or available only to special populations like active duty military or veterans. Abbreviations: CDSR – Cochrane Database of Systematic Reviews; RCT – randomized controlled trial.

Figure 2.

Difference in mean hemoglobin A1c change (%) between commercial programs and comparators among populations with type 2 diabetes mellitus, displayed by time point. Diamond size is standardized across trials and does not reflect sample size analyzed.

*Results reported in more than one article. **Results from completers' analysis only.

***Trials where reported attrition was not reported or was high (attrition ≥ 30% in one arm or difference in attrition between arms was ≥ 20%). Abbreviations: C – Comparator; LC – Low Carbohydrate Version; NR – Not Reported; P – Commercial Program.

Figure 3.

Difference in mean glucose change (mmol/L) between commercial programs and comparators among populations with type 2 diabetes mellitus, displayed by time point. Diamond size is standardized across trials and does not reflect sample size analyzed. To convert mmol/L to mg/dL, divide values by 0.05551. *Results reported in more than one article. **Results from completers' analysis only. ***Trials where reported attrition was not reported or was high (attrition ≥ 30% in one arm or difference in attrition between arms was ≥ 20%). Abbreviations: C – Comparator; NR – Not Reported; P – Commercial Program.

Figure 4.

Difference in mean glucose change (mmol/L) between commercial programs and comparators among populations at increased risk of type 2 diabetes mellitus displayed by time point displayed. Diamond size is standardized across trials and does not reflect sample size analyzed. To convert mmol/L to mg/dL, divide values by 0.05551. *Results reported in more than one article. **Results from completers' analysis only. ***Trials where reported attrition was not reported or was high (attrition ≥ 30% in one arm or difference in attrition between arms was ≥ 20%). Abbreviations: C – Comparator; HMR – Health Management Resources; NR – Not Reported; P – Commercial Program; WW – Weight Watchers.

Table 1

Population Characteristics among Included Randomized Controlled Trials, by Program and Comparator among Individuals with Type 2 Diabetes Mellitus

Commercial Program	Comparator	RCTs, <i>n</i> (<i>N</i> eligible)	Ranges of Baseline Population Characteristics					RCTs with Commercial Program Support, <i>n</i>
			Study Duration, <i>months</i>	Mean Age, <i>years</i>	Women, %	White, % Black, %	Mean BMI, <i>kg/m</i> ²	
Market Leading Programs								
Jenny Craig	Control/education	0	--	--	--	--	--	--
	Counseling	1 (227)	12	57	47–58	78–82 3–10	36	8.05–8.10
NutriSystem	Control/education	1 (69)	3	53	68–74	37–44 44–60	39	8.30–8.40
	Counseling	1 (100)	6	56	58–60	32–40 54–64	36	8.00–8.96
Intensive Very-Low-Calorie or Low-Calorie Meal Replacement Programs								
OPTIFAST	Control/education	0	--	--	--	--	--	--
	Counseling	1 (93)	6	52	63–67	NR NR	38	12.19–12.81
Self-Directed and Other Programs								
SlimFast	Control/education	0	--	--	--	--	--	--
	Counseling	2 (139)	3–12	54–59	33–41	NR NR	32–34	8.96–9.18
Atkins	Control/education	0	--	--	--	--	--	--
	Counseling	2 (136)	12–24	54	74–82 [*]	14–15 [*] 62–66 [*]	35–37 [*]	NR

* Not all trials reported this characteristic. Abbreviations: BMI – body mass index; NR – not reported; RCT – randomized controlled trial.

Population Characteristics among Included Randomized Controlled Trials, by Program and Comparator among Individuals at Increased Risk of Type 2 Diabetes Mellitus

Table 2

Commercial Program	Comparator	RCTs, <i>n</i> (N eligible)	Ranges of Baseline Population Characteristics					Mean glucose, <i>mmol/L</i>	RCTs with Commercial Program Support, <i>n</i>	
			Study Duration, <i>months</i>	Mean Age, <i>years</i>	Women, %	White, % Black, %	Mean BMI, <i>kg/m</i> ²			
Market Leading Programs										
Weight Watchers	Control/education	3 (1,314)	3–24	40–48	72–88	74 [*] 13 [*]	31–34	4.94–5.55 [*]	2	
	Counseling	0	--	--	--	--	--	--	--	
Intensive Very-Low-Calorie or Low-Calorie Meal Replacement Programs										
HMR	Control/education	0	--	--	--	--	--	--	--	
	Counseling	1 (38)	6	45–51	75–77	91–94 6–9	35–36	4.84–5.17	0	
Self-Directed and Other Programs										
SlimFast	Control/education	3 (275)	3–12	39–50	35–82	NR NR	32–34	4.37–6.33	2	
	Counseling	0	--	--	--	--	--	--	--	
Atkins	Control/education	1 (118)	12	41	75	NR NR	32	4.48	0	
	Counseling	3 (432)	6–24	40–52	9–100	59–79 [*] 3–12 [*]	31–37	5.00–5.33 [*]	1	
The Biggest Loser Club	Control/education	1 (203)	3	42	59	NR NR	32	4.80–5.00	1	
	Counseling	0	--	--	--	--	--	--	--	
Curves	Control/education	1 (48)	3	48	100	NR NR	36	NR	1	
	Counseling	0	--	--	--	--	--	--	--	

^{*} Not all trials reported this characteristic. Abbreviations: BMI – body mass index; HMR – Health Management Resources; NR – not reported; RCT – randomized controlled trial.

Table 3

Changes in Diabetes Medications in Patients with Type 2 Diabetes Mellitus

Author, Year	Duration, months	Eligible Arms	Overall N N on Insulin N on Oral Hypoglycemics	Reduction in Insulin, %	Reduction in Oral Hypoglycemics, %
Rock, 2014 (15)	12	Counseling	76	8	16
			12		
			62		
		Jenny Craig	74	63	39
			19		
			62		
		LC - Jenny Craig	77	90	30
			10		
			69		
Foster, 2013 (17)	6	Counseling	50	--	4*
			11		
			47		
		Nutrisystem	50	--	28*,**
			9		
			47		
Li, 2005 (19)	12	Counseling	36	--	18 (sulfonylurea) 23 (metformin)
			0		
			36		
		Slimfast	46	--	40 (sulfonylurea)** 29 (metformin)**
			0		
			46		
Yip, 2001(20)	3	Counseling	16	--	38
			0		
			16		
		Slimfast	41	--	59
			0		
			41		

* Overall reduction in diabetes medications reported.

** P<0.05 for comparison with comparator arm. Abbreviations: LC: Low Carbohydrate.