Supplementary Materials

Table legends

Figure legends

Table S1. Full electronic search strategy for EMBASE, MEDLINE, and Cochrane Central Register of Controlled Trials

Data Base	**Full electronic search strategy**
EMBASE	'muscle strength'/exp OR 'weight lifting'/exp OR 'circuit training'/exp OR 'resistance training'/exp OR 'aerobic training'/exp OR 'kinesiotherapy'/exp OR 'exercise'/exp AND 'diabetes mellitus'/exp AND 'continuous glucose monitoring'/exp
MEDLINE	((("Exercise"[Mesh] OR "Circuit-Based Exercise"[Mesh] OR "Cool-Down Exercise"[Mesh] OR "Warm-Up Exercise"[Mesh] OR "Exercise Movement Techniques"[Mesh] OR "Exercise Therapy"[Mesh] OR "Exercise Test"[Mesh] OR "Resistance Training"[Mesh] OR "Muscle Stretching Exercises"[Mesh] OR "High-Intensity Interval Training"[Mesh]) AND ("Diabetes Mellitus"[Mesh] OR "Diabetes, Gestational"[Mesh] OR "Diabetes Mellitus, Type 2"[Mesh]))) AND (continuous glucose monitoring)
Cochrane Central Register of Controlled Trials	"Diabetes Mellitus" or "Diabetes Insipidus" and "muscle strength" or "muscle strengthening" or "muscle-strengthening" or "weight lifting" or weightlifting or "weight bearing" or weight-bearing or "weight training" or "circuit training" or "strength exercise" or "strengthening exercise" or "strength training" or "resistance exercise" or "resistance training" or "progressive resistance" or "Physical Exercise" or "Isometric Exercise" or "aerobic exercise" or "aerobic training" or "exercise therapy" and "continuous glucose monitoring"

Table S2. Description of the exercise models of included random control trials

Author, year	Exercise duration	Mean adherence (%)	Treatment group	Specific exercise type	Relative intensity values	Exercise time/ total sets per sessions	Frequency
Paddy 2017(1)	24 hours	100	Light-intensity walking	Walking	NA	Sitting plus 3 min bouts of light-intensity walking at 3.2 km/h every 30 min;	NA
			Simple resistance activities	Alternating half-squats, calf raises, brief gluteal contractions and knee raises	NA	Sitting plus 3 min bouts of simple resistance activities every 30 min	NA
			Control	prolonged sitting	NA	NA	NA
Jonida 2016(2)	24hours	NA	Continous walking	Walking on the treadmill	50 %	Continous walking 40min	1 session per 24 hours
			Split walking	Walking on the treadmill	50 %	Split walking 20min+20min	1 session per 24 hours
			Control	NA	NA	NA	NA
Jordan 2019(3)	24hours	100	Exercise	Walking on the treadmill	NA	Walking at 5.0 km/hour and 0.5%	1 session per 24

						incline; A 5-min warm up and cooldown at a pace of 3.5 km/hour and 0.0% grade were included	hours
			Control	50 min of sitting	NA	NA	1 session per 24 hours
Zheng Li 2018(4)	24hours	100	Exercise	walking on a treadmill after dinner	40%	20min	1 session per 24 hour
			control	NA	NA	NA	NA
Richard 2018(5)	24hours	100	Reduced-exertion high-intensity interval training (REHIT)	performed on mechanically braked cycle ergometer	Exercise at a resistance equivalent to 5% of body mass	10 × 60 s cycling efforts interspersed with 60 s of low-intensity recovery	1 session per 24 hours
			Moderate–vigorous-intensity continuous exercise 30 min (MICT)	performed on an electronically braked cycle ergometer	50%	30 min of continuous cycling a	1 session per 24 hours
			High-intensity	performed on an	85%	10 × 60 s cycling	1 session

			interval training (HIIT)	electronically braked cycle ergometer		efforts interspersed with 60 s of low-intensity recovery	per 24 hours
			Control	NA	NA	NA	NA
Kristian 2017(6)	2weeks	99%	Continuous walking	Walking on a treadmill	73%	60min	5 days per week
			interval walking training	Walking on a treadmill	54% and 89%	60min, alternating cycles of 3 min slow walking (54% of $\dot{V}O_2$ peak) and 3 min fast walking (89% of VO 2peak).	5 days per week
			control	NA	NA	NA	NA
Myette-Côté 2016(7)	24 hours	NA	Exercise	Walking	NA	50 minutes	1 session per 24 hours
			control	NA	NA	NA	NA
Tasuku 2016(8)	24hours	NA	Moderate-intensity continuous exercise	Exercise on a treadmill	55%	60min	1 session per 24 hours
			High-intensity interval	Exercise on a treadmill	40%-100%	60min (3 minutes at	1 session per 24

			exercise			workload corresponding to 40% 1minute at workload corresponding to 100% VO_2 peak)	hours
			Control	NA	NA	NA	NA
Jennifer 2019(9)	24h	100%	morning walk after breakfast	continuous brisk walk	NA	20min, 40min, and 60min	1 session per 24 hours
			post-meal breaks from sitting	short physical activity	NA	short physical activity	NA
			control	NA	NA	NA	NA
Matthew 2020(10)	12 days	NA	Morning exercise	Walking on a treadmill at 5.0 km/h with 0.5% grade.	NA	40 minutes at 5.0 km/h with 0.5% grade.	1session per24hours
			Afternoon exercise	Walking on a treadmill at 5.0 km/h with 0.5% grade.	NA	40 minutes at 5.0 km/h with 0.5% grade.	1session per24hours
			Evening exercise	Walking on a treadmill at 5.0 km/h with 0.5%	NA	40 minutes at 5.0 km/h with 0.5% grade.	1session per24hours

				grade.			
			control	NA	NA	NA	NA
Ravi 2019(11)	3weeks	NA	Aerobic exercise	Treadmill exercise	60%	45min	2sessions per week
			resistance exercise	five different exercises (leg press, bench press, leg extension, leg flexion and seated row)	60-80%	three sets of 8–12 repetitions	2sessions per week
			control	NA	NA	NA	NA
Kamilla 2018(12)	11weeks	NA	Endurance training	Cycling	50%	40 min	3 days per week
			High-intensity interval training	Cycling	95%	1 min intervals at 95% of peak workload interspersed by 1 min active recovery for 20 min	3 days per week
			Control	Daily activities	NA	NA	NA
Angela 2020(13)	12weeks	67%	high-intensity interval training	cycle ergometer or treadmill	60–95%peakheartrate	5 min of warm-up at60%peak heartrate 4 bouts of 4-min high-intensity intervals at	3 days per week

					85–95% HR peak Three bouts of 3-min recovery intervals at 50– 70%HR peak	
	65%	control	Daily activities	NA	NA	NA

HR: heart rate; NA: not available;

Table S3. The risk of bias for included random control trials

Author, year	Adequate randomization sequence generation	Adequate allocation concealment	Blinding of participants and caregivers	Binding of outcome assessors and adjudicators	Free of infrequent missing outcome data	Free of selective outcome reporting	Free of other bias
Paddy 2017(1)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Jonida Haxhi 2016(2)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Jordan L.Rees 2019(3)	**Probably yes** Randomized	**Probably no** Randomized, Open label	**Definitely no** Open	**Definitely yes**	**Probably yes** There	**Definitely yes**	**Probably yes** Generally

	d, Open label		label		were 21.1% patients with missing outcome data; The ing outcome data were generally balanced across treatment groups, with similar reasons for missing data		balanced baseline characteristics across groups
Zheng Li 2018(4)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Richard S.Metcalfe 2018(5)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteris

							tics across groups
Kristian Karstoft 2017(6)	**Definitely yes** Randomized, Open label Computer generated randomization	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Probably yes** There were 9.1% (1/11) patients with missing outcome data; The missing outcome data were generally balanced across treatment groups, with similar reasons for missing data	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Myette-Côté 2016(7)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Tasuku	**Probably**	**Probably no**	**Definitely**	**Definitely yes**	**Definitely**	**Definitely**	**Probably**

2016(8)	**yes** Randomized, Open label	Randomized, Open label	**no** Open label		**yes** There were 0% missing outcome data;	**yes**	**yes** Generally balanced baseline characteristics across groups
Jennifer 2019(9)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Matthew 2020(10)	**Probably yes** Randomized, Open label a Latin square	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Probably yes** There were 21.4% (3/14) patients with missing outcome data; The missing outcome data were generally balanced across treatment	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups

					groups, with similar reasons for missing data		
Ravi Reddy 2019(11)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Kamilla 2018(12)	**Definitely yes** Randomized, Open label sealed envelopes	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Definitely yes** There were 0% missing outcome data;	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across groups
Angela 2020(13)	**Probably yes** Randomized, Open label	**Probably no** Randomized, Open label	**Definitely no** Open label	**Definitely yes**	**Probably yes** There were 16.7% (2/12) and 20% (3/15) patients in exercise and	**Definitely yes**	**Probably yes** Generally balanced baseline characteristics across

	control groups with missing outcome data, respectively; missing outcome data were generally balanced across treatment groups, with similar reasons for missing data	groups

Table S4. GRADE Working Group grades of evidence for included trials

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Physical activity	Control	Relative (95% CI)	Absolute		
MAGE (Better indicated by lower values)												
19	randomised trials	serious[1]	serious[2]	no serious indirectness	no serious imprecision	none	303	311	-	MD 0.68 lower (1.01 to 0.36 lower)	⊕⊕OO LOW	not available
TIR (Better indicated by lower values)												
6	randomised trials	serious[3]	no serious inconsistency	no serious indirectness	no serious imprecision	none	120	112	-	MD 4.17 higher (1.11 to 7.23 higher)	⊕⊕⊕O MODERATE	not available
TAR (Better indicated by lower values)												
19	randomised trials	serious[3]	no serious inconsistency	no serious indirectness	no serious imprecision	none	265	265	-	MD 3.54 lower (5.21 to 1.88 lower)	⊕⊕⊕O MODERATE	not available
TBR (Better indicated by lower values)												
8	randomised trials	serious[3]	serious	no serious indirectness	no serious imprecision	none	95	87	-	MD 1.54 higher (0.24 lower to 3.32 higher)	⊕⊕OO LOW	not available

[1] Lack of blinding

[2] Unexplained high heterogeneity of results

[3] Unexplained heterogeneity of results

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

Figure S1. Funnel plot of RCTs included in this meta-analysis

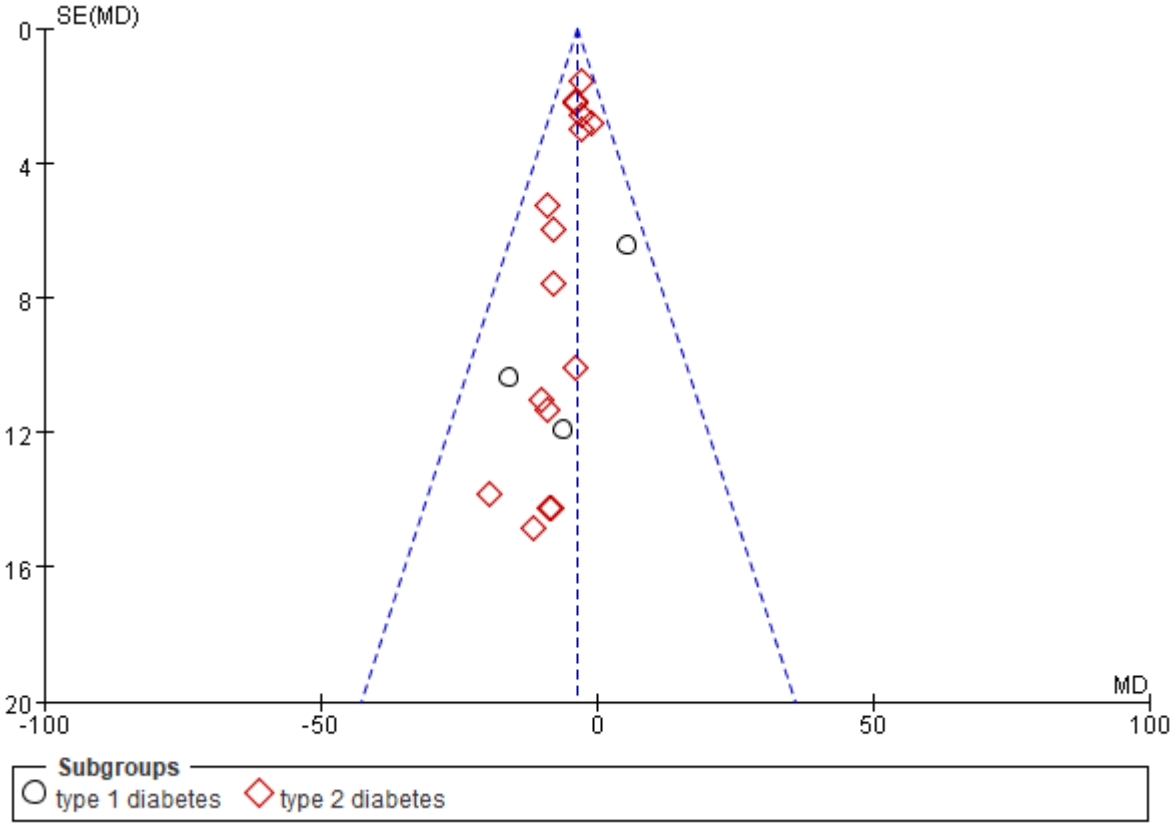

SE(MD)
0
4
8
12
16
20
-100
-50
0
50
100
MD
Subgroups
type 1 diabetes
type 2 diabetes

Figure S2. Beggs test of RCTs included in this meta-analysis

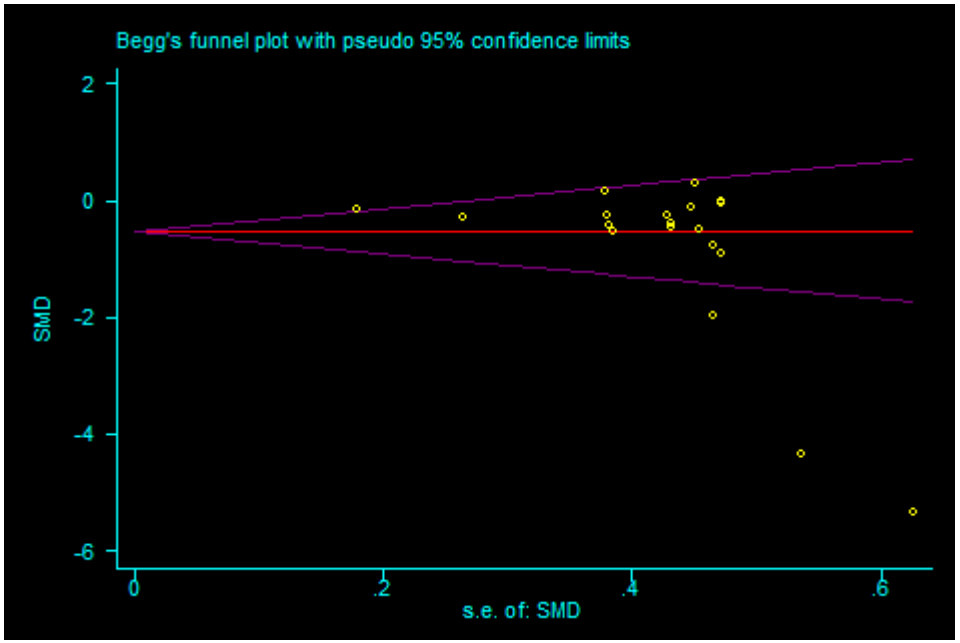
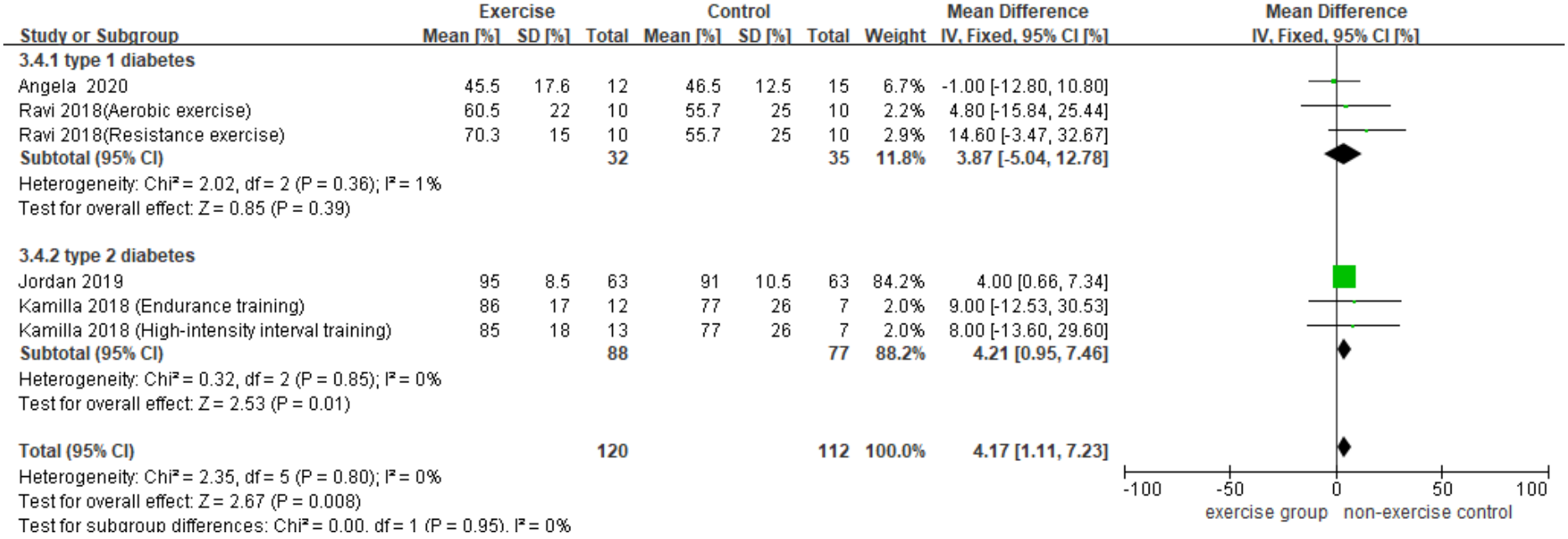
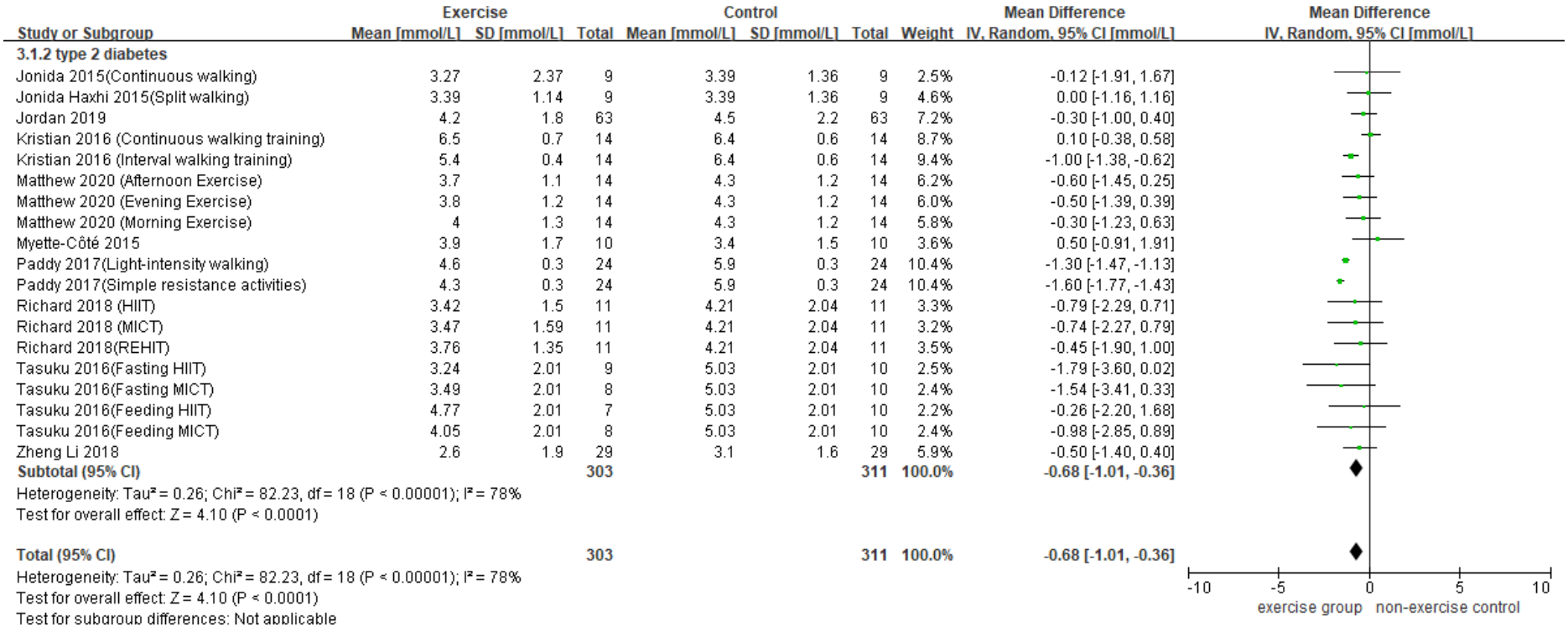


Figure S3. Comparison of TIR change between physical activity treatment group and control group stratified by disease type



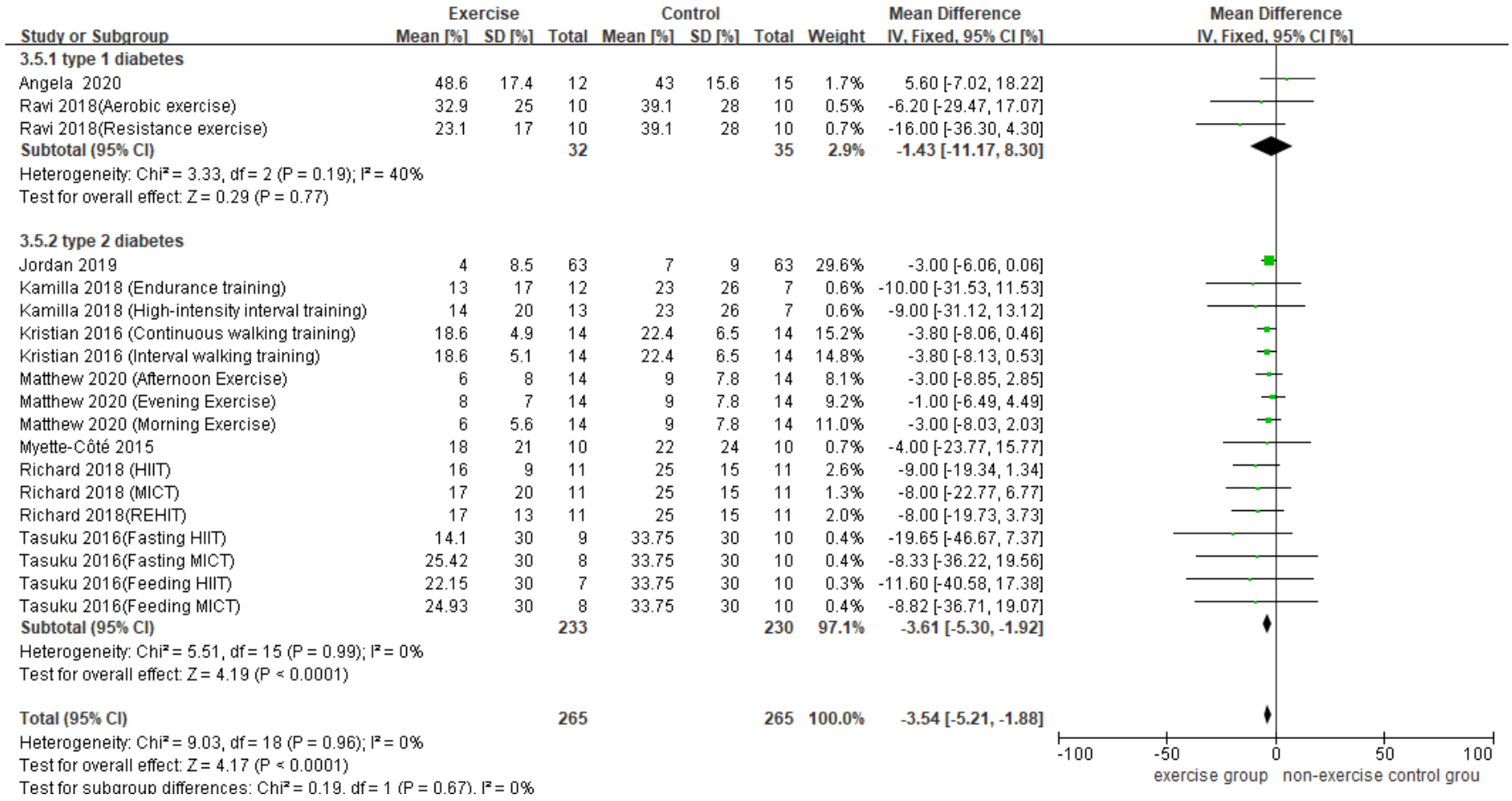
CI: confidential interval;

Figure S4. Comparison of MAGE change between physical activity treatment group and control group stratified by disease type



CI: confidential interval;

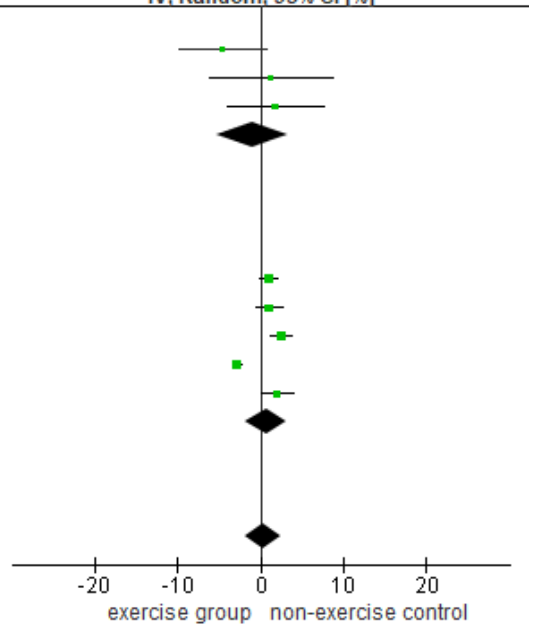
Figure. S5 Comparison of TAR change between physical activity treatment group and control group stratified by disease type



TAR: time above range; CI: confidential interval;

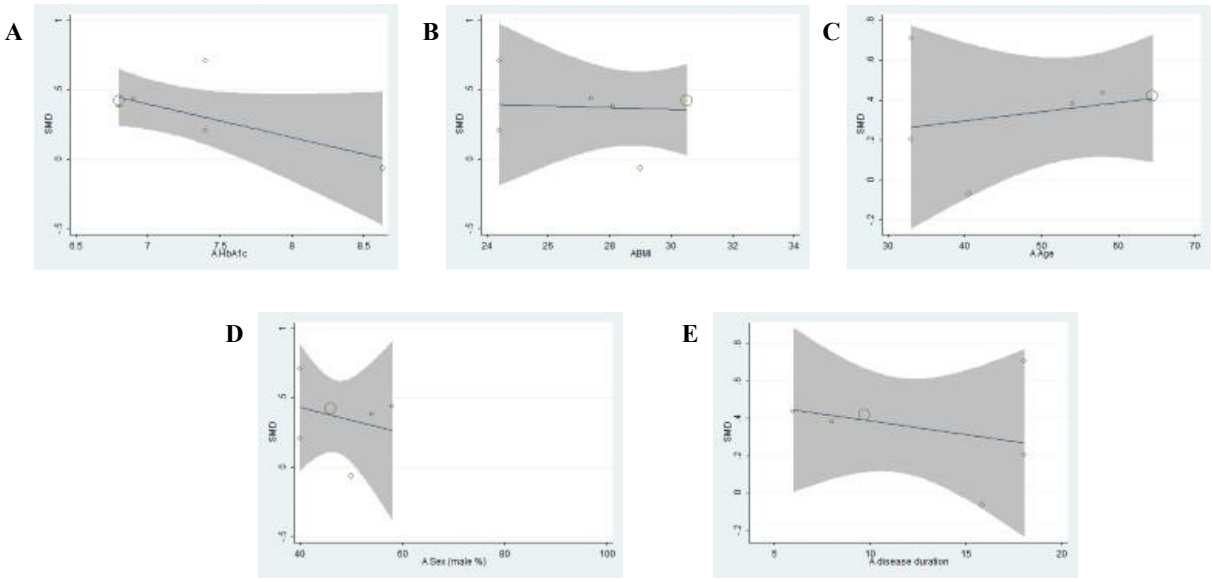
Figure. S6 Comparison of TBR change between physical activity treatment group and control group stratified by disease type

Study or Subgroup	Exercise Mean [%]	Exercise SD [%]	Exercise Total	Control Mean [%]	Control SD [%]	Control Total	Weight	Mean Difference IV, Random, 95% CI [%]
3.6.1 type 1 diabetes								
Angela 2020	5.9	4	12	10.5	9.4	15	8.4%	-4.60 [-9.87, 0.67]
Ravi 2018(Aerobic exercise)	3.17	9.83	10	1.86	7.15	10	5.5%	1.31 [-6.22, 8.84]
Ravi 2018(Resistance exercise)	3.63	6.07	10	1.86	7.15	10	7.5%	1.77 [-4.04, 7.58]
Subtotal (95% CI)			**32**			**35**	**21.4%**	**-0.89 [-5.22, 3.44]**
Heterogeneity: Tau² = 5.00; Chi² = 3.03, df = 2 (P = 0.22); I² = 34%								
Test for overall effect: Z = 0.40 (P = 0.69)								
3.6.2 type 2 diabetes								
Kamilla 2018 (Endurance training)	1	2	12	0	0.001	7	16.1%	1.00 [-0.13, 2.13]
Kamilla 2018 (High-intensity interval training)	1	3	13	0	0.001	7	15.4%	1.00 [-0.63, 2.63]
Kristian 2016 (Continuous walking training)	5.3	2.2	14	2.8	1.2	14	15.8%	2.50 [1.19, 3.81]
Kristian 2016 (Interval walking training)	0	0.001	14	2.8	1.2	14	16.6%	-2.80 [-3.43, -2.17]
Myette-Côté 2015	2.1	3.2	10	0.1	0.3	10	14.7%	2.00 [0.01, 3.99]
Subtotal (95% CI)			**63**			**52**	**78.6%**	**0.69 [-1.78, 3.15]**
Heterogeneity: Tau² = 7.41; Chi² = 85.05, df = 4 (P < 0.00001); I² = 95%								
Test for overall effect: Z = 0.55 (P = 0.58)								
Total (95% CI)			**95**			**87**	**100.0%**	**0.36 [-1.79, 2.51]**
Heterogeneity: Tau² = 7.13; Chi² = 88.08, df = 7 (P < 0.00001); I² = 92%								
Test for overall effect: Z = 0.33 (P = 0.74)								
Test for subgroup differences: Chi² = 0.38, df = 1 (P = 0.54), I² = 0%								



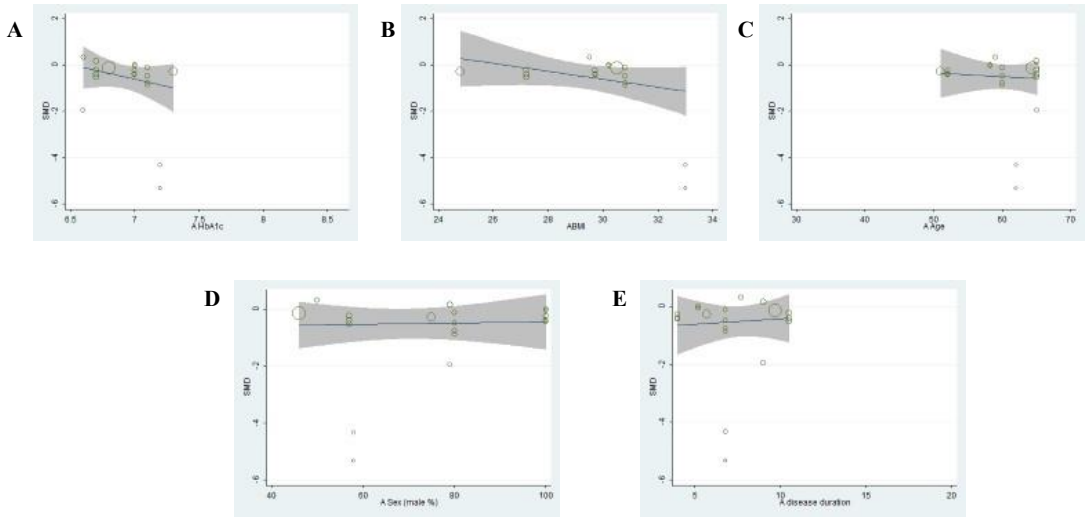
TBR: time below range; CI: confidential interval;

Figure. S7 Associated factors with the change of TIR by meta-regression analysis. Associated factors: Baseline HbA1c (A), Baseline BMI (B), Baseline age (C), Baseline male percentage (D), and Disease duration (E)



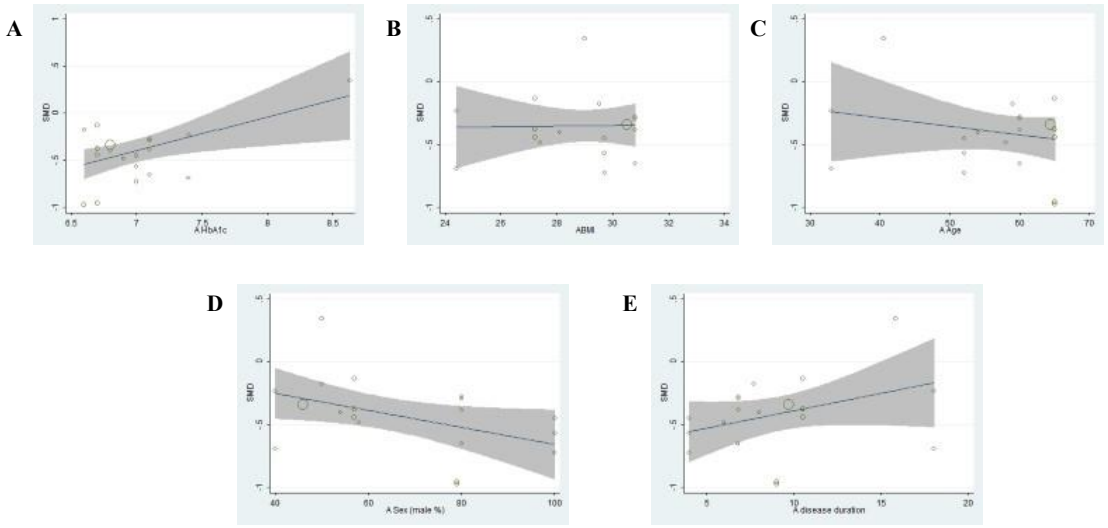
HbA1c: Hemoglobin A1c; BMI: body mass index; TIR: time in range;

Figure. S8 Associated factors with the change of MAGE by meta-regression analysis. Associated factors: Baseline HbA1c (A), Baseline BMI (B), Baseline age (C), Baseline male percentage (D), and Disease duration (E)



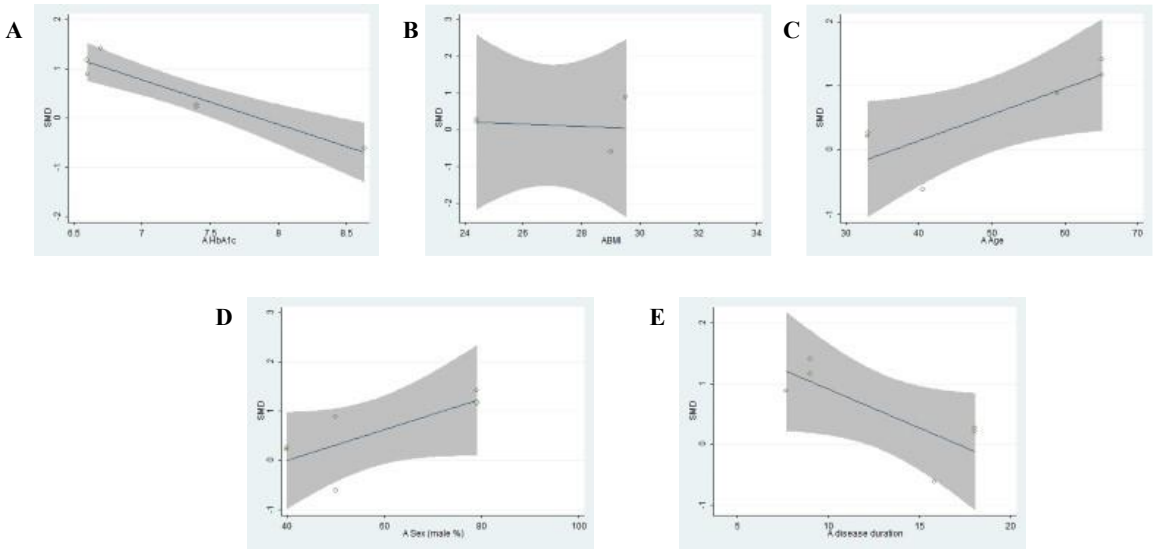
HbA1c: Hemoglobin A1c; BMI: body mass index; MAGE: mean amplitude of glycemic excursion;

Figure. S9 Associated factors with the change of TAR by meta-regression analysis. Associated factors: Baseline HbA1c (A), Baseline BMI (B), Baseline age (C), Baseline male percentage (D), and Disease duration (E)



HbA1c: Hemoglobin A1c; BMI: body mass index; TAR: time above range;

Figure. S10 Associated factors with the change of TBR by meta-regression analysis. Associated factors: Baseline HbA1c (A), Baseline BMI (B), Baseline age (C), Baseline male percentage (D), and Disease duration (E)



HbA1c: Hemoglobin A1c; BMI: body mass index; TBR: time below range;

Reference

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