

Table S1. Associations between various clinical treatment strategies and endocrine-metabolic outcomes.

Outcomes	Intervention	Control	Total eligible MA	Included MA	Sample size intervention/control	MA metric	Estimates [95% CI]	No. of studies	Effects model	I ² ; Q test P value	Egger's test P value
Significant associations											
FBG	CHM	placebo	1	Peng, Sihan.2022[27]	733/730	SMD	-0.96[-1.26,-0.65]	18	Random	86%;<0.00001	0.83
FBG	Liraglutide	other pharmaceuticals	2	Zhao, Y.2023[2]	554/579	SMD	-1.26[-1.77,-0.74]	14	Random	93%;<0.00001	NA
PBG	GLP-1RAs	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	249/348	SMD	-0.88[-1.33,-0.43]	9	Random	84%;<0.00001	0.17
PBG	Exenatide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	114/134	SMD	-0.48[-0.73,-0.23]	3	Fixed	0.0%;0.6	NA
PBG	Liraglutide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	135/214	SMD	-1.16[-1.91,-0.41]	6	Random	89%;<0.00001	NA
2-hour PBG	CHM	placebo	1	Peng, Sihan.2022[27]	595/592	SMD	-0.99[-1.34,-0.65]	14	Random	87%;<0.00001	0.821
HbA1c	Liraglutide	other pharmaceuticals	3	Zhao, Y.2023[2]	605/631	SMD	-0.91[-1.33,-0.49]	15	Random	91%;<0.00001	NA
HbA1c	dapagliflozin	placebo	2	Duan, H.2025[35]	145/149	SMD	-0.60[-1.02;-0.17]	4	Random	64%;0.04	NA
HbA1c	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	76/63	SMD	-1.12[-1.75;-0.48]	3	Random	57%;0.10	NA
HbA1c	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	28/22	SMD	-0.71[-1.37;-0.05]	2	Random	19%;0.27	NA
HbA1c	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	121/102	SMD	-0.85[-1.33;-0.37]	6	Random	61%;0.03	NA
HOMA-IR	CHM	placebo	1	Peng, Sihan.2022[27]	313/311	SMD	-1.32[-1.60,-1.04]	9	Random	60%;0.01	NA
HOMA-IR	SGLT-2 inhibitors	placebo or other pharmaceuticals	2	Jin, Z.2023[32]	147/132	SMD	-0.70[-1.36;-0.04]	6	Random	85%;<0.00001	NA
HOMA-IR	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	1	Ma, G.2025[38]	456/456	SMD	-0.46[-0.66,-0.26]	10	Random	50%;0.03	NA
HOMA-IR	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	76/63	SMD	-0.59[-0.94;-0.25]	3	Random	0%;0.93	NA
HOMA-IR	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	30/15	SMD	-1.73[-3.40;-0.06]	2	Random	79%;0.03	NA
HOMA-IR	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	121/86	SMD	-0.83[-1.31;-0.36]	6	Random	52%;0.06	NA
Non-significant associations											
FBG	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Wei, Q.2021[29]	242/197	MD	-4.32[-9.74;1.09]	9	Random	77%;<0.0001	NA
FBG	dapagliflozin	placebo	2	Duan, H.2025[35]	115/149	SMD	-0.55[-1.10;0.00]	4	Random	77%;0.005	NA
FBG	GLP-1RAs	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	597(total)	WMD	-2.12[-6.23;1.96]	9	Random	15.8%;0.31	0.008
FBG	Exenatide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	0.00[-4.59;4.59]	3	Random	0.0%;0.65	NA
HbA1c	GLP-1RAs	other pharmaceuticals	2	Nowrouzi-Sohrabi, P.2021[41]	597(total)	WMD	-0.08[-0.21;0.04]	9	Random	0.0%;0.18	0.21
HbA1c	Exenatide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	-0.12[-0.31;0.08]	3	Random	22.1%;0.27	NA
HbA1c	SGLT-2 inhibitors	placebo or other pharmaceuticals	3	Wei, Q.2021[29]	242/197	MD	-0.16[-0.38;0.06]	9	Random	91%;<0.00001	NA

HOMA-IR	dapagliflozin	placebo	1	Hu, C.2023[42]	38/40	SMD	-0.36[-0.86;0.14]	2	Random	20%;0.26	NA
HOMA-IR	GLP-1RAs	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	477(total)	WMD	-0.31[-0.69;0.07]	6	Random	92.9%;0.11	0.69
HOMA-IR	Liraglutide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	-0.43[-1.18;0.32]	3	Random	46.6%;0.13	NA
HOMA-IR	Exenatide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	-0.28[-0.81;0.24]	3	Random	97.4%;< 0.0001	NA

CHM:Chinese Herbal Medicine;HOMA-IR:homeostatic model assessment of insulin resistance;FBG:fasting blood glucose;DPP-4 inhibitors:Dipeptidyl peptidase-4 inhibitors;SGLT-2:sodium-glucose cotransporter 2 inhibitor;GLP-1RAs:glucagon-like peptide-1 receptor agonists;HbA1c:hemoglobin A1c; HIIT:high-intensity Interval Training;MICT: moderate-intensity continuous training;CI: confidence interval; NA: not available; RCTs:Randomized controlled trials;SMD:standardised mean differences;WMD:weighted mean differences;MD:mean difference;MA, meta-analysis.

Table S2. Associations between various clinical treatment strategies and lipid metabolism outcomes.

Outcomes	Intervention	Control	Total eligible MA	Included MA	Sample size intervention/control	MA metric	Estimates [95% CI]	No. of studies	Effects model	I ² ; Q test P value	Egger's test P value
Significant associations											
TG	CHM	placebo	1	Peng, Sihan.2022[27]	690/687	SMD	-0.75[-1.12,-0.38]	17	Random	91%;<0.00001	0.599
TG	SGLT-2 inhibitors	placebo or other pharmaceuticals	2	Jin, Z.2023[32]	174/160	SMD	-0.81[-1.49;-0.12]	6	Random	88%;<0.00001	NA
TG	GLP-1RAs	placebo or other pharmaceuticals	1	Ghosal, S.2021[18]	189/212	SMD	-0.22[-0.42;-0.03]	6	Fixed	0%;0.02	NA
TG	Liraglutide	other pharmaceuticals	2	Zhao, Y.2023[2]	556/581	SMD	-0.96[-1.09,-0.83]	13	Random	94%;<0.00001	NA
TG	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	30/15	SMD	-1.59[-2.58;-0.61]	2	Random	45%; 0.18	NA
TG	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	121/86	SMD	-1.60[-2.68;-0.51]	6	Random	89%;<0.00001	NA
TC	CHM	placebo	1	Peng, Sihan.2022[27]	609/606	SMD	-0.78[-1.10,-0.47]	15	Random	85%;<0.00001	0.909
TC	Liraglutide	other pharmaceuticals	2	Zhao, Y.2023[2]	538/563	SMD	-0.96[-1.43,-0.50]	12	Random	92%;<0.00001	NA
TC	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	76/63	SMD	-0.94[-1.82;-0.07]	3	Random	77%;0.01	NA
TC	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	151/117	SMD	-0.70[-1.29;-0.11]	8	Random	79%;<0.0001	NA
LDL-C	CHM	placebo	1	Peng, Sihan.2022[27]	591/588	SMD	-0.71[-1.05,-0.37]	15	Random	87%;<0.00001	0.016
LDL-C	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	64/52	SMD	-0.87[-1.26;-0.49]	2	Random	0%;0.85	NA
LDL-C	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	109/75	SMD	-0.91[-1.37;-0.45]	5	Random	41%;0.14	NA
HDL-C	CHM	placebo	1	Peng, Sihan.2022[27]	516/513	SMD	0.69[0.36,1.02]	13	Random	84%;<0.00001	0.213
HDL-C	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	43/29	SMD	0.53[0.04;1.02]	3	Random	0%;0.57	NA
Non-significant associations											
TG	dapagliflozin	placebo	1	Duan, H.2025[35]	58/58	SMD	-0.30[-1.47;0.88]	2	Random	88%;0.004	NA
TG	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	76/63	SMD	-1.88[-3.91;0.16]	3	Random	94%;<0.00001	NA
TC	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	43/29	SMD	-0.22[-0.71;0.26]	3	Random	0%;0.39	NA
TC	RT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	32/25	SMD	-1.12[-3.47;1.22]	2	Random	92%;0.0004	NA
LDL-C	dapagliflozin	placebo	1	Duan, H.2025[35]	58/58	SMD	-0.19[-0.56;0.17]	2	Fixed	0%;0.66	NA
LDL-C	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	30/15	SMD	-0.49[-1.13;0.14]	2	Random	0%;0.38	NA
HDL-C	liraglutide	other pharmaceuticals	2	Zhao, Y.2023[2]	261/264	MD	0.07[-0.07;0.21]	9	Random	97%;<0.00001	NA
HDL-C	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	64/52	SMD	-0.21[-1.75;1.32]	2	Random	90%;0.002	NA
HDL-C	RT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	32/25	SMD	0.25[-0.29;0.78]	2	Random	0%;0.43	NA
HDL-C	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	139/106	SMD	0.23[-0.36;0.83]	7	Random	78%;0.0001	NA

LDL-C	Liraglutide	other pharmaceuticals	2	Zhao, Y.2023[2]	527/529	SMD	-0.34[-0.82,0.14]	13	Random	93%;<0.00001	NA
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TG:triglyceride;TC:total cholesterol;LDL-C:low-density lipoprotein cholesterol; HDL-C,high-density lipoprotein cholesterol; CHM:Chinese Herbal Medicine; HIIT:high-intensity Interval Training;MICT: moderate-intensity continuous training;RT: resistance training;SGLT-2:sodium–glucose cotransporter 2 inhibitor;GLP-1RAs:glucagon-like peptide-1 receptor agonists;CI: confidence interval; NA: not available; RCTs:Randomized controlled trials;SMD:standardised mean differences;WMD:weighted mean differences;MD:mean difference;MA, meta-analysis.

Table S3. Associations between various clinical treatment strategies and hepatic health outcomes.

Outcomes	Intervention	Control	Total eligible MA	Included MA	Sample size intervention/control	MA metric	Estimates [95% CI]	No. of studies	Effects model	I ² ; Q test P value	Egger's test P value
Significant associations											
ALT	CHM	placebo	1	Peng, Sihan.2022[27]	703/700	SMD	-0.77[-1.13,-0.40]	17	Random	90%;<00001	0.139
ALT	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	1	Ma, G.2025[38]	740/741	SMD	-0.34[-0.55,-0.14]	21	Random	71%;<0.00001	0.98
ALT	SGLT-2 inhibitors	placebo or other pharmaceuticals	5	Jin, Z.2023[32]	200/189	SMD	-0.39[-0.71;-0.08]	7	Random	54%;0.04	NA
ALT	dapagliflozin	placebo	2	Duan, H.2025[35]	125/129	SMD	-1.10[-1.37,-0.84]	3	Fixed	40%;0.19	NA
ALT	GLP-1RAs	placebo or other pharmaceuticals	2	Ghosal, S.2021[18]	189/212	SMD	-0.56[-0.88;-0.25]	6	Random	56.89;< 0.01	NA
ALT	Liraglutide	other pharmaceuticals	3	Zhao, Y.2023[2]	343/368	SMD	-0.99[-1.51;-0.46]	10	Random	91%;<0.00001	NA
ALT	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	75/58	SMD	-0.38[-0.74,-0.03]	5	Fixed	11%;0.34	NA
AST	CHM	placebo	1	Peng, Sihan.2022[27]	703/700	SMD	-0.80[-1.11,-0.49]	17	Random	87%;<0.00001	0.666
AST	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	1	Ma, G.2025[38]	740/741	SMD	-0.36[-0.59,-0.14]	21	Random	77%;<0.00001	0.67
AST	SGLT-2 inhibitors	placebo or other pharmaceuticals	5	Jin, Z.2023[32]	200/189	SMD	-0.35[-0.67;-0.02]	7	Random	57%;0.03	NA
AST	dapagliflozin	placebo	2	Duan, H.2025[35]	125/129	SMD	-1.32[-1.76;-0.88]	3	Random	57%;0.10	NA
AST	GLP-1RAs	placebo or other pharmaceuticals	2	Ghosal, S.2021[18]	189/212	SMD	-0.44[-0.64;-0.24]	6	Fixed	14.84%;< 0.01	NA
GGT	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	1	Ma, G.2025[38]	479/486	SMD	-0.96[-1.37,-0.54]	11	Random	88%;<0.00001	NA
GGT	GLP-1RAs	placebo or other pharmaceuticals	2	Ghosal, S.2021[18]	119/120	SMD	-0.60[-0.86;-0.34]	4	Fixed	0%;< 0.01	NA
serum ferritin	SGLT-2 inhibitors	placebo or other pharmaceuticals	2	Jin, Z.2023[32]	96/97	SMD	-1.36[-2.14;-0.57]	4	Random	82%;0.0008	NA
CAP	SGLT-2 inhibitors	placebo or other pharmaceuticals	3	Ong Lopez, AMC.2024[36]	147/135	SMD	-0.35[-0.59,-0.11]	5	Fixed	0%;0.97	0.129
PDFF	SGLT-2 inhibitors	placebo or other pharmaceuticals	5	Ong Lopez, AMC.2024[36]	154/138	SMD	-0.75[-0.98,-0.51]	4	Fixed	0%;0.95	0.129
FLI	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Song, Tiantian.2021[39]	56/41	SMD	-0.80[-1.22,-0.37]	2	Fixed	6%;0.3	NA
liver fat content	GLP-1RAs	placebo or other pharmaceuticals	2	Ghosal, S.2021[18]	85/85	SMD	-0.43[-0.74;-0.12]	3	Fixed	0%;< 0.01	NA
liver fat	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Sinha, B.2021[40]	NA	SMD	-0.98[-1.53;-0.44]	4	Random	69.68%;<0.01	NA
LSM	SGLT-2 inhibitors	placebo or other pharmaceuticals	2	Ong Lopez, AMC.2024[36]	184/173	SMD	-0.50[-0.89,-0.12]	6	Random	68%;0.009	0.129
FIB-4 index	SGLT-2 inhibitors	placebo or other pharmaceuticals	3	Jin, Z.2023[32]	155/156	SMD	-0.37[-0.74;-0.01]	6	Random	59%;0.03	NA
serum type 4 collagen 7s	SGLT-2 inhibitors	placebo or other pharmaceuticals	2	Jin, Z.2023[32]	150/132	SMD	-0.66[-1.20;-0.12]	6	Random	78%;0.0004	NA
Non-significant associations											
AST	liraglutide	other pharmaceuticals	3	Zhao, Y.2023[2]	343/368	SMD	-0.52[-1.11;0.08]	10	Random	93%;<0.00001	NA
ALP	Liraglutide	placebo or other pharmaceuticals	2	Xu, Yuan-Yuan.2024[3]	64/67	MD	-0.93[-2.93;1.07]	4	Fixed	0%;0.98	NA
GGT	Liraglutide	placebo or other pharmaceuticals	2	Xu, Yuan-Yuan.2024[3]	94/97	MD	-0.93[-4.24;2.38]	5	Random	85%;<0.0001	NA
GGT	SGLT-2 inhibitors	placebo or other pharmaceuticals	3	Jin, Z.2023[32]	163/147	SMD	-0.89[-2.07;0.30]	6	Random	95%;<0.00001	NA
liver fat content	Liraglutide	placebo or other pharmaceuticals	2	Xu, Yuan-Yuan.2024[3]	114/107	MD	-1.18[-2.85;0.49]	5	Random	81%;0.0003	NA
FIB-4 index	GLP-1RAs	placebo or other pharmaceuticals	1	Zhu, Y.2021[34]	117/121	MD	-0.04[-0.15;0.08]	5	Fixed	44%;0.13	NA
NAFLDFS	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Song, Tiantian.2021[39]	62/39	SMD	-0.32[-0.95;0.31]	2	Random	57%;0.13	NA
L/S ratio	SGLT-2 inhibitors	placebo or other pharmaceuticals	2	Ong Lopez, AMC.2024[36]	80/83	SMD	1.22[-0.46;2.90]	3	Random	95%;<0.00001	0.129
NFS	GLP-1RAs	placebo or other pharmaceuticals	1	Zhu, Y.2021[34]	82/85	MD	-0.16[-0.56;0.24]	4	Fixed	0%;0.99	NA

ALT	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	30/19	SMD	-0.55[-1.15,0.04]	2	Fixed	17%;0.27	NA
ALT	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	28/22	SMD	-0.43[-1.38,0.53]	2	Random	62%;0.11	NA

CHM:Chinese Herbal Medicine;DPP-4 inhibitors:Dipeptidyl peptidase-4 inhibitors;SGLT-2:sodium-glucose cotransporter 2 inhibitor;GLP-1RAs:glucagon-like peptide-1 receptor agonists;HIIT:high-intensity Interval Training;MICT: moderate-intensity continuous training;ALT:alanine transaminase; AST:aspartate transaminase;GGT:gamma-glutamyl transpeptidase;LSM:Liver stiffness measurement;FLI:liver fat index;PDFF:Liver proton density fat fraction; L/S:Liver-to-spleen attenuation; CAP:Controlled attenuation parameter;NAFLDFS:liver fat score;FIB-4 index:fibrosis 4 index;NFS:NAFLD fibrosis score;ALP:Alkaline phosphatase;CI: confidence interval; NA: not available; RCTs:Randomized controlled trials;SMD:standardised mean differences;WMD:weighted mean differences;MD:mean difference;MA, meta-analysis.

Table S4. Associations between various clinical treatment strategies and body composition outcomes.

Outcomes	Intervention	Control	Total eligible MA	Included MA	Sample size intervention/control	MA metric	Estimates [95% CI]	No. of studies	Effects model	I ² ; Q test P value	Egger's test P value
Significant associations											
body weight	SGLT-2 inhibitors	placebo or other pharmaceuticals	3	Wei, Q.2021[29]	226/181	SMD	-2.99[-4.57,-1.42]	8	Random	97%;<0.00001	NA
body weight	GLP-1RAs	other pharmaceuticals	2	Nowrouzi-Sohrabi, P.2021[41]	249/348	SMD	-0.84[-1.52,-0.16]	9	Random	93%;<0.00001	0.07
WC	GLP-1RAs	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	148/205	SMD	-0.94[-1.48,-0.39]	7	Random	81%;<0.0001	0.005
BMI	CHM	placebo	1	Peng, Sihan.2022[27]	366/364	SMD	-0.29[-0.53,-0.05]	11	Random	63%;0.002	0.014
BMI	GLP-1RAs	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	249/348	SMD	-0.87[-1.49,-0.26]	9	Random	91%;<0.00001	0.41
BMI	Liraglutide	placebo or other pharmaceuticals	3	Xu, Yuan-Yuan.2024[3]	347/365	SMD	-0.90[-1.20,-0.59]	14	Random	72%;<0.0001	NA
BMI	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Jin, Z.2023[32]	232/205	SMD	-1.42[-2.21;-0.62]	9	Random	92%;<0.00001	NA
BMI	HIIT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	64/52	SMD	-0.43[-0.80;-0.06]	2	Fixed	0%;0.85	NA
BMI	exercise intervention	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	139/106	SMD	-0.32[-0.58;-0.06]	7	Fixed	0%;0.97	NA
SAT	Liraglutide	placebo or other pharmaceuticals	1	Xu, Yuan-Yuan.2024[3]	191/189	SMD	-0.43[-0.63,-0.22]	8	Fixed	49%;0.06	NA
SAT	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Wang, X.2023[31]	196/178	SMD	-2.73[-4.33;-1.13]	7	Random	97%;<0.00001	NA
SAT	GLP-1RAs	placebo or other pharmaceuticals	1	Zhu, Y.2021[34]	145/147	SMD	-0.63[-0.87,-0.39]	5	Fixed	43%;0.14	NA
VAT	Liraglutide	placebo or other pharmaceuticals	1	Xu, Yuan-Yuan.2024[3]	191/189	SMD	-0.68[-1.21,-0.16]	8	Random	82%;<0.00001	NA
VAT	SGLT-2 inhibitors	placebo or other pharmaceuticals	4	Jin, Z.2023[32]	204/190	SMD	-2.90[-4.65;-1.16]	6	Random	98%;<0.00001	NA
VAT	GLP-1RAs	placebo or other pharmaceuticals	1	Zhu, Y.2021[34]	145/147	SMD	-1.07[-1.64,-0.49]	5	Random	81%;0.0003	NA
SFA	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Wei, Q.2021[29]	131/93	SMD	-1.77[-3.46,-0.08]	4	Random	96%;<0.00001	NA
VFM	SGLT-2 inhibitors	placebo or other pharmaceuticals	1	Sinha, B.2021[40]	NA	SMD	-0.51[-0.83;-0.20]	3	Random	0%; <0.01	NA
IHA	GLP-1RAs	placebo or other pharmaceuticals	1	Zhu, Y.2021[34]	276/275	SMD	-0.50[-0.84,-0.16]	12	Random	73%;<0.0001	NA
Non-significant associations											
body weight	Liraglutide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	-3.42[-8.14;1.30]	6	Random	94.7%;<0.0001	NA
body weight	Exenatide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	-5.69[-11.94;0.55]	3	Random	98.5%;<0.0001	NA
WHR	GLP-1RAs	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	375(total)	WMD	-0.01[-0.03;0.02]	4	Random	96.2%;0.57	0.49
BMI	Exenatide	other pharmaceuticals	1	Nowrouzi-Sohrabi, P.2021[41]	NA	WMD	-1.98[-4.33;0.37]	3	Random	99.1%;<0.0001	NA
BMI	MICT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	43/29	SMD	-0.33[-0.81;0.16]	3	Fixed	0%;0.87	NA
BMI	RT	placebo or usual care with no physical activity	1	Zeng, Y.2024[28]	32/25	SMD	-0.10[-0.62;0.43]	2	Fixed	0%;0.97	NA

CHM:Chinese Herbal Medicine;HIIT:high-intensity Interval Training;SGLT-2:sodium–glucose cotransporter 2 inhibitor;GLP-1RAs:glucagon-like peptide-1 receptor agonists;BMI:body mass index;WC:waist circumference; IHA:intrahepatic adipose;VFM:visceral fat mass;VAT:Visceral Adipose Tissue;SAT:Subcutaneous Adipose Tissue;SFA:subcutaneous fat areas;WHR:waist-to-hip ratio;CI: confidence interval; NA: not available; RCTs:Randomized controlled trials;SMD:standardised mean differences;WMD:weighted mean differences;MD:mean difference;MA, meta-analysis.

Table S5. Assessments of AMSTAR scores, GRADE classification and evidence classification.

Outcome	Intervention	Study	Study design	AMSTAR	GRADE	Evidence class
Endocrine & metabolic outcomes						
FBG	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
FBG	Liraglutide	Zhao, Y.2023[2]	RCTs	7	low	IV
PBG	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	IV
PBG	Exenatide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	high	IV
PBG	Liraglutide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	IV
2-hour PBG	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
HbA1c	Liraglutide	Zhao, Y.2023[2]	RCTs	7	low	IV
HbA1c	dapagliflozin	Duan, H.2025[35]	RCTs	7	low	IV
HbA1c	HIIT	Zeng, Y.2024[28]	RCTs	8	moderate	IV
HbA1c	MICT	Zeng, Y.2024[28]	RCTs	8	moderate	IV
HbA1c	exercise intervention	Zeng, Y.2024[28]	RCTs	8	moderate	IV
HOMA-IR	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
HOMA-IR	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
HOMA-IR	DPP-4 inhibitors	Ma, G.2025[38]	RCTs	9	moderate	IV
HOMA-IR	HIIT	Zeng, Y.2024[28]	RCTs	8	high	IV
HOMA-IR	MICT	Zeng, Y.2024[28]	RCTs	8	low	IV
HOMA-IR	exercise intervention	Zeng, Y.2024[28]	RCTs	8	moderate	IV
FBG	SGLT-2 inhibitors	Wei, Q.2021[29]	RCTs	7	low	NS
FBG	dapagliflozin	Duan, H.2025[35]	RCTs	7	low	NS
FBG	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	NS
FBG	Exenatide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	NS
HbA1c	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	NS
HbA1c	Exenatide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	NS
HbA1c	SGLT-2 inhibitors	Wei, Q.2021[29]	RCTs	7	low	NS
HOMA-IR	dapagliflozin	Hu, C.2023[42]	RCTs	7	moderate	NS
HOMA-IR	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	NS
HOMA-IR	Liraglutide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	NS
HOMA-IR	Exenatide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	NS
Blood lipid metabolism outcomes						
TG	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
TG	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
TG	GLP-1RAs	Ghosal, S.2021[18]	RCTs	9	moderate	IV
TG	Liraglutide	Zhao, Y.2023[2]	RCTs	7	low	IV
TG	MICT	Zeng, Y.2024[28]	RCTs	8	moderate	IV
TG	exercise intervention	Zeng, Y.2024[28]	RCTs	8	low	IV
TC	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
TC	Liraglutide	Zhao, Y.2023[2]	RCTs	7	low	IV
TC	HIIT	Zeng, Y.2024[28]	RCTs	8	low	IV
TC	exercise intervention	Zeng, Y.2024[28]	RCTs	8	low	IV
LDL-C	CHM	Peng, Sihan.2022[27]	RCTs	11	very low	IV
LDL-C	HIIT	Zeng, Y.2024[28]	RCTs	8	high	IV
LDL-C	exercise intervention	Zeng, Y.2024[28]	RCTs	8	high	IV

HDL-C	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
HDL-C	MICT	Zeng, Y.2024[28]	RCTs	8	moderate	IV
LDL-C	Liraglutide	Zhao, Y.2023[2]	RCTs	7	very low	NS
TG	dapagliflozin	Duan, H.2025[35]	RCTs	7	low	NS
TG	HIIT	Zeng, Y.2024[28]	RCTs	8	low	NS
TC	MICT	Zeng, Y.2024[28]	RCTs	8	moderate	NS
TC	RT	Zeng, Y.2024[28]	RCTs	8	low	NS
LDL-C	dapagliflozin	Duan, H.2025[35]	RCTs	7	moderate	NS
LDL-C	MICT	Zeng, Y.2024[28]	RCTs	8	moderate	NS
HDL-C	liraglutide	Zhao, Y.2023[2]	RCTs	7	very low	NS
HDL-C	HIIT	Zeng, Y.2024[28]	RCTs	8	low	NS
HDL-C	RT	Zeng, Y.2024[28]	RCTs	8	moderate	NS
HDL-C	exercise intervention	Zeng, Y.2024[28]	RCTs	8	low	NS
Liver health outcomes						
ALT	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
ALT	DPP-4 inhibitors	Ma, G.2025[38]	RCTs	9	low	IV
ALT	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
ALT	dapagliflozin	Duan, H.2025[35]	RCTs	7	high	IV
ALT	GLP-1RAs	Ghosal, S.2021[18]	RCTs	9	low	IV
ALT	Liraglutide	Zhao, Y.2023[2]	RCTs	7	low	IV
ALT	exercise intervention	Zeng, Y.2024[28]	RCTs	8	moderate	IV
AST	CHM	Peng, Sihan.2022[27]	RCTs	11	low	IV
AST	DPP-4 inhibitors	Ma, G.2025[38]	RCTs	9	low	IV
AST	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
AST	dapagliflozin	Duan, H.2025[35]	RCTs	7	moderate	IV
AST	GLP-1RAs	Ghosal, S.2021[18]	RCTs	9	moderate	IV
GGT	DPP-4 inhibitors	Ma, G.2025[38]	RCTs	9	moderate	IV
GGT	GLP-1RAs	Ghosal, S.2021[18]	RCTs	9	moderate	IV
serum ferritin	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	moderate	IV
CAP	SGLT-2 inhibitors	Ong Lopez, AMC.2024[36]	RCTs	10	moderate	IV
PDFF	SGLT-2 inhibitors	Ong Lopez, AMC.2024[36]	RCTs	10	high	IV
FLI	SGLT-2 inhibitors	Song, Tiantian.2021[39]	RCTs	7	high	IV
liver fat content	GLP-1RAs	Ghosal, S.2021[18]	RCTs	9	moderate	IV
liver fat	SGLT-2 inhibitors	Sinha, B.2021[40]	RCTs	8	low	IV
LSM	SGLT-2 inhibitors	Ong Lopez, AMC.2024[36]	RCTs	10	low	IV
FIB-4 index	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
serum type 4 collagen 7s	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
NAFLDFS	SGLT-2 inhibitors	Song, Tiantian.2021[39]	RCTs	7	low	NS
L/S ratio	SGLT-2 inhibitors	Ong Lopez, AMC.2024[36]	RCTs	10	low	NS
ALT	HIIT	Zeng, Y.2024[28]	RCTs	8	moderate	NS
ALT	MICT	Zeng, Y.2024[28]	RCTs	8	low	NS
AST	liraglutide	Zhao, Y.2023[2]	RCTs	7	very low	NS
ALP	Liraglutide	Xu, Yuan-Yuan.2024[3]	RCTs	8	moderate	NS
GGT	Liraglutide	Xu, Yuan-Yuan.2024[3]	RCTs	8	low	NS
GGT	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	NS

liver fat content	Liraglutide	Xu, Yuan-Yuan.2024[3]	RCTs	8	low	NS
FIB-4 index	GLP-1RAs	Zhu, Y.2021[34]	RCTs	8	moderate	NS
NFS	GLP-1RAs	Zhu, Y.2021[34]	RCTs	8	moderate	NS
Body composition outcomes						
body weight	SGLT-2 inhibitors	Wei, Q.2021[29]	RCTs	7	moderate	IV
body weight	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	IV
WC	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	IV
BMI	CHM	Peng, Sihan.2022[27]	RCTs	11	very low	IV
BMI	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	IV
BMI	Liraglutide	Xu, Yuan-Yuan.2024[3]	RCTs	8	moderate	IV
BMI	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	moderate	IV
BMI	HIIT	Zeng, Y.2024[28]	RCTs	8	moderate	IV
BMI	exercise intervention	Zeng, Y.2024[28]	RCTs	8	moderate	IV
SAT	Liraglutide	Xu, Yuan-Yuan.2024[3]	RCTs	8	high	IV
SAT	SGLT-2 inhibitors	Wang, X.2023[31]	RCTs	9	moderate	IV
SAT	GLP-1RAs	Zhu, Y.2021[34]	RCTs	8	high	IV
VAT	Liraglutide	Xu, Yuan-Yuan.2024[3]	RCTs	8	low	IV
VAT	SGLT-2 inhibitors	Jin, Z.2023[32]	RCTs	8	low	IV
VAT	GLP-1RAs	Zhu, Y.2021[34]	RCTs	8	moderate	IV
SFA	SGLT-2 inhibitors	Wei, Q.2021[29]	RCTs	7	low	IV
VFM	SGLT-2 inhibitors	Sinha, B.2021[40]	RCTs	8	moderate	IV
IHA	GLP-1RAs	Zhu, Y.2021[34]	RCTs	8	low	IV
body weight	Liraglutide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	NS
body weight	Exenatide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	NS
WHR	GLP-1RAs	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	moderate	NS
BMI	Exenatide	Nowrouzi-Sohrabi, P.2021[41]	RCTs	9	low	NS
BMI	MICT	Zeng, Y.2024[28]	RCTs	8	moderate	NS
BMI	RT	Zeng, Y.2024[28]	RCTs	8	moderate	NS

CHM:Chinese Herbal Medicine;T2DM:Type 2 Diabetes Mellitus;NAFLD:Nonalcoholic Fatty Liver Disease;TG:triglyceride;TC:total cholesterol;LDL-C:low-density lipoprotein cholesterol; HDL-C,high-density lipoprotein cholesterol; ALT:alanine transaminase; AST:aspartate transaminase;HOMA-IR:homeostatic model assessment of insulin resistance;FBG:fasting blood glucose;BMI:body mass index;DPP-4 inhibitors:Dipeptidyl peptidase-4 inhibitors;GGT:gamma-glutamyl transpeptidase; GLP-1RAs:glucagon-like peptide-1 receptor agonists;HbA1c:hemoglobin A1c; WC:waist circumference; WHR:waist-to-hip ratio; SGLT-2:sodium–glucose cotransporter 2 inhibitor;LSM:Liver stiffness measurement;PDF:Liver proton density fat fraction; L/S:Liver-to-spleen attenuation; CAP:Controlled attenuation parameter;LF:liver fat content;HIIT:high-intensity Interval Training;MICT: moderate-intensity continuous training;RT: resistance training;VAT:Visceral Adipose Tissue;SAT:Subcutaneous Adipose Tissue;FIB-4 index:fibrosis 4 index;SFA:subcutaneous fat areas;ALP:Alkaline phosphatase;FLI:liver fat index;NAFLDFS:liver fat score;VFM:visceral fat mass;NFS:NAFLD fibrosis score;IHA:intrahepatic adipose.CI: confidence interval; NA: not available; SMD:standardised mean differences;RCTs:Randomized controlled trials; WMD:weighted mean differences;MD:mean difference;GRADE:Grades of Recommendation, Assessment, Development and Evaluation;AMSTAR:A Measure Tool to Assess Systematic Reviews.

Table S6. Assessments of AMSTAR scores.

Outcomes	Intervention	Control	Study	A priori design provided	Duplicate study selection & data extraction	At least two electronic databases searched	Status of publication used as an inclusion criterion	List of included and excluded studies provided	Characteristics of included studies provided	Scientific quality of included studies assessed	Scientific quality of the included studies used appropriately to form conclusions	Appropriate methods to combine studies	Publication bias assessed	Conflict of interest included	Total AMSTAR Score
TG	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
TC	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
LDL-C	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
HDL-C	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
ALT	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
AST	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
HOMA-IR	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
FBG	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
2-hour PBG	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
BMI	CHM	placebo	Peng, Sihan.2022[27]	1	1	1	1	1	1	1	1	1	1	1	11
ALT	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	Ma, G.2025[38]	1	1	1	0	1	1	1	0	1	1	1	9
AST	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	Ma, G.2025[38]	1	1	1	0	1	1	1	0	1	1	1	9
HOMA-IR	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	Ma, G.2025[38]	1	1	1	0	1	1	1	0	1	1	1	9
GGT	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimepiride) or control diet, exercise	Ma, G.2025[38]	1	1	1	0	1	1	1	0	1	1	1	9
PBG	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9

BMI	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
body weight	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
WC	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
PBG	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
PBG	Liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
FBG	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
HbA1c	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
HOMA-IR	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
WHR	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
FBG	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
HbA1c	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
HOMA-IR	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
BMI	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
body weight	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
HOMA-IR	Liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
body weight	Liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	1	1	1	0	1	1	1	0	1	1	1	9
CAP	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	0	1	1	1	1	1	1	1	1	1	1	10
L/S ratio	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	0	1	1	1	1	1	1	1	1	1	1	10
PDFF	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	0	1	1	1	1	1	1	1	1	1	1	10
LSM	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	0	1	1	1	1	1	1	1	1	1	1	10
FBG	Liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
HbA1c	Liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7

TG	Liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
TC	Liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
ALT	Liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
LDL-C	Liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
AST	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
HDL-C	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	0	0	1	0	1	1	1	0	1	1	1	7
ALT	dapagliflozin	placebo	Duan, H.2025[35]	0	1	1	0	1	1	1	0	1	0	1	7
AST	dapagliflozin	placebo	Duan, H.2025[35]	0	1	1	0	1	1	1	0	1	0	1	7
HbA1c	dapagliflozin	placebo	Duan, H.2025[35]	0	1	1	0	1	1	1	0	1	0	1	7
FBG	dapagliflozin	placebo	Duan, H.2025[35]	0	1	1	0	1	1	1	0	1	0	1	7
LDL-C	dapagliflozin	placebo	Duan, H.2025[35]	0	1	1	0	1	1	1	0	1	0	1	7
TG	dapagliflozin	placebo	Duan, H.2025[35]	0	1	1	0	1	1	1	0	1	0	1	7
BMI	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
BMI	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
ALT	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
ALT	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
ALT	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
TG	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
TG	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
TC	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8

TC	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
LDL-C	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
LDL-C	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HDL-C	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HbA1c	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HbA1c	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HbA1c	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HOMA-IR	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HOMA-IR	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HOMA-IR	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
BMI	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
BMI	RT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
TG	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
TC	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
TC	RT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8

LDL-C	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HDL-C	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HDL-C	RT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HDL-C	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	0	1	1	0	1	1	1	1	1	0	1	8
HOMA-IR	dapagliflozin	placebo	Hu, C.2023[42]	0	1	1	0	1	1	1	0	1	0	1	7
BMI	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	0	1	1	0	1	1	1	0	1	1	1	8
SAT	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	0	1	1	0	1	1	1	0	1	1	1	8
VAT	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	0	1	1	0	1	1	1	0	1	1	1	8
ALP	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	0	1	1	0	1	1	1	0	1	1	1	8
GGT	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	0	1	1	0	1	1	1	0	1	1	1	8
LF	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	0	1	1	0	1	1	1	0	1	1	1	8
AST	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
ALT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
BMI	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
serum ferritin	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
FIB-4 index	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
HOMA-IR	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
TG	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
serum type 4 collagen 7s	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
VAT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8

GGT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	1	1	1	0	1	1	1	0	1	0	1	8
SFA	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	0	1	1	0	1	1	1	0	1	0	1	7
body weight	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	0	1	1	0	1	1	1	0	1	0	1	7
FBG	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	0	1	1	0	1	1	1	0	1	0	1	7
HbA1c	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	0	1	1	0	1	1	1	0	1	0	1	7
<i>FLI</i>	SGLT-2 inhibitors	placebo or other pharmaceuticals	Song, Tiantian.2021[39]	0	1	1	0	1	1	1	0	1	0	1	7
<i>NAFLDFS</i>	SGLT-2 inhibitors	placebo or other pharmaceuticals	Song, Tiantian.2021[39]	0	1	1	0	1	1	1	0	1	0	1	7
<i>liver fat</i>	SGLT-2 inhibitors	placebo or other pharmaceuticals	Sinha, B.2021[40]	0	1	1	0	1	1	1	0	1	1	1	8
<i>VFM</i>	SGLT-2 inhibitors	placebo or other pharmaceuticals	Sinha, B.2021[40]	0	1	1	0	1	1	1	0	1	1	1	8
<i>SAT</i>	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wang, X.2023[31]	1	1	1	0	1	1	1	0	1	1	1	9
ALT	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	1	1	1	0	1	1	1	0	1	1	1	9
AST	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	1	1	1	0	1	1	1	0	1	1	1	9
GGT	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	1	1	1	0	1	1	1	0	1	1	1	9
liver fat content	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	1	1	1	0	1	1	1	0	1	1	1	9
TG	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	1	1	1	0	1	1	1	0	1	1	1	9
IHA	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	1	1	1	0	1	1	1	0	1	0	1	8
SAT	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	1	1	1	0	1	1	1	0	1	0	1	8
VAT	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	1	1	1	0	1	1	1	0	1	0	1	8
FIB-4 index	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	1	1	1	0	1	1	1	0	1	0	1	8
NFS	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	1	1	1	0	1	1	1	0	1	0	1	8

CHM:Chinese Herbal Medicine;T2DM:Type 2 Diabetes Mellitus;NAFLD:Nonalcoholic Fatty Liver Disease;TG:triglyceride;TC:total cholesterol;LDL-C:low-density lipoprotein cholesterol; HDL-C,high-density lipoprotein cholesterol; ALT:alanine transaminase; AST:aspartate transaminase;HOMA-IR:homeostatic model assessment of insulin resistance;FBG:fasting blood glucose;BMI:body mass index;DPP-4 inhibitors:Dipeptidyl peptidase-4 inhibitors;GGT:gamma-glutamyl transpeptidase;GLP-1RAs:glucagon-like peptide-1 receptor agonists; HbA1c:hemoglobin A1c; WC:waist circumference; WHR:waist-to-hip ratio;SGLT-2:sodium–glucose cotransporter 2 inhibitor;LSM:Liver stiffness measurement;PDFF:Liver proton density fat fraction; L/S:Liver-to-spleen attenuation; CAP:Controlled attenuation parameter;LF:liver fat content;HIIT:high-intensity Interval Training;MICT: moderate-intensity continuous training;RT: resistance training;AMSTAR:A Measure Tool to Assess Systematic Reviews. VAT:Visceral Adipose Tissue;SAT:Subcutaneous Adipose Tissue;FIB-4 index:fibrosis 4 index;SFA:subcutaneous fat areas;ALP:Alkaline phosphatase;FLI:liver fat index;NAFLDFS:liver fat score;VFM:visceral fat mass;NFS:NAFLD fibrosis score;IHA:intrahepatic adipose.CI: confidence interval; NA: not available; SMD:standardised mean differences;RCTs:Randomized controlled trials; WMD:weighted mean differences;MD:mean difference;GRADE:Grades of Recommendation, Assessment, Development and Evaluation.

Table S7. GRADE classification of quality of evidence.

Outcomes	Intervention	Control	Study	No. of RCTs	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Plausible confounding	Magnitude of effect	Dose-response gradient	Quality
Significant associations													
TG	CHM	placebo	Peng, Sihan.2022[27]	17	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
TC	CHM	placebo	Peng, Sihan.2022[27]	15	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
LDL-C	CHM	placebo	Peng, Sihan.2022[27]	15	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	strongly suspected	would not reduce effect	no	no	very low
HDL-C	CHM	placebo	Peng, Sihan.2022[27]	13	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
ALT	CHM	placebo	Peng, Sihan.2022[27]	17	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
AST	CHM	placebo	Peng, Sihan.2022[27]	17	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
HOMA-IR	CHM	placebo	Peng, Sihan.2022[27]	9	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	low
FBG	CHM	placebo	Peng, Sihan.2022[27]	18	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
2-hour PBG	CHM	placebo	Peng, Sihan.2022[27]	14	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
BMI	CHM	placebo	Peng, Sihan.2022[27]	11	serious risk	serious inconsistency	no serious indirectness	serious imprecision	strongly suspected	would not reduce effect	no	no	very low
ALT	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimpiride) or control diet, exercise	Ma, G.2025[38]	21	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low
AST	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimpiride) or control diet, exercise	Ma, G.2025[38]	21	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low
HOMA-IR	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimpiride) or control diet, exercise	Ma, G.2025[38]	10	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	moderate
GGT	DPP-4 inhibitors	pharmaceuticals(Metformin, Glimpiride) or control diet, exercise	Ma, G.2025[38]	11	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	moderate
PBG	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	9	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	moderate
BMI	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	9	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low
body weight	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	9	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low

WC	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	7	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	strongly suspected	would not reduce effect	no	no	low
CAP	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	5	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	moderate
L/S ratio	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	3	no serious risk	serious inconsistency	n oserious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low
PDFF	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	4	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	high
LSM	SGLT-2 inhibitors	placebo or other pharmaceuticals	Ong Lopez, AMC.2024[36]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low
FBG	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	14	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
HbA1c	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	15	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
TG	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	13	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
TC	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	12	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
ALT	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	10	serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	low
LDL-C	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	13	serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	very low
PBG	liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
PBG	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
ALT	dapagliflozin	placebo	Duan, H.2025[35]	3	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
AST	dapagliflozin	placebo	Duan, H.2025[35]	3	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
HbA1c	dapagliflozin	placebo	Duan, H.2025[35]	4	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
BMI	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
BMI	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	7	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate

ALT	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
ALT	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
ALT	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	5	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
TG	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
TG	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
TC	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
TC	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	8	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
LDL-C	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
LDL-C	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	5	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
HDL-C	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
HbA1c	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
HbA1c	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
HbA1c	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	6	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
HOMA-IR	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
HOMA-IR	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
HOMA-IR	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	6	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate

BMI	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	14	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	moderate
VAT	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	8	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
SAT	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	8	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
PBG	Liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	6	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
AST	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	7	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
ALT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	7	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
BMI	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	9	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
serum ferritin	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	4	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
FIB-4 index	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
HOMA-IR	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
TG	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
serum type 4 collagen 7s	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
VAT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
SFA	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	4	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
body weight	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	8	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
FLI	SGLT-2 inhibitors	placebo or other pharmaceuticals	Song, Tiantian.2021[39]	2	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high

NAFLDFS	SGLT-2 inhibitors	placebo or other pharmaceuticals	Song, Tiantian.2021[39]	2	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
liver fat	SGLT-2 inhibitors	placebo or other pharmaceuticals	Sinha, B.2021[40]	4	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
VFM	SGLT-2 inhibitors	placebo or other pharmaceuticals	Sinha, B.2021[40]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
SAT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wang, X.2023[31]	7	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
ALT	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
AST	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	6	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
GGT	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	4	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
liver fat content	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
TG	GLP-1RAs	placebo or other pharmaceuticals	Ghosal, S.2021[18]	6	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
IHA	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	12	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	low
SAT	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	5	no serious risk	no serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	high
VAT	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	5	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	NA	would not reduce effect	no	no	moderate
Non-significant associations													
FBG	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	9	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	strongly suspected	would not reduce effect	no	no	low
HbA1c	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	9	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	moderate
HOMA-IR	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	6	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	moderate
WHR	GLP-1RAs	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	4	no serious risk	serious inconsistency	no serious indirectness	no serious imprecision	undetected	would not reduce effect	no	no	moderate

AST	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	10	serious risk	serious inconsistency	no serious indirectness	serious imprecision	undetected	would not reduce effect	no	no	very low
HDL-C	liraglutide	other pharmaceuticals	Zhao, Y.2023[2]	9	serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	very low
FBG	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
HbA1c	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
HOMA-IR	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
BMI	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
body weight	Exenatide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
FBG	dapagliflozin	placebo	Duan, H.2025[35]	4	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
LDL-C	dapagliflozin	placebo	Duan, H.2025[35]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
TG	dapagliflozin	placebo	Duan, H.2025[35]	2	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
BMI	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
BMI	RT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
TG	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
TC	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
TC	RT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
LDL-C	MICT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
HDL-C	HIIT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low

					risk								
HDL-C	RT	placebo or usual care with no physical activity	Zeng, Y.2024[28]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
HDL-C	exercise intervention	placebo or usual care with no physical activity	Zeng, Y.2024[28]	7	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
HOMA-IR	dapagliflozin	placebo	Hu, C.2023[42]	2	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
ALP	liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	4	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
GGT	liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	5	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
LF	Liraglutide	placebo or other pharmaceuticals	Xu, Yuan-Yuan.2024[3]	5	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
HOMA-IR	Liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	3	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
body weight	Liraglutide	other pharmaceuticals	Nowrouzi-Sohrabi, P.2021[41]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
GGT	SGLT-2 inhibitors	placebo or other pharmaceuticals	Jin, Z.2023[32]	6	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
FBG	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	9	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
HbA1c	SGLT-2 inhibitors	placebo or other pharmaceuticals	Wei, Q.2021[29]	9	no serious risk	serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	low
FIB-4 index	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	5	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate
NFS	GLP-1RAs	placebo or other pharmaceuticals	Zhu, Y.2021[34]	4	no serious risk	no serious inconsistency	no serious indirectness	serious imprecision	NA	would not reduce effect	no	no	moderate

CHM:Chinese Herbal Medicine;T2DM:Type 2 Diabetes Mellitus;NAFLD:Nonalcoholic Fatty Liver Disease;TG:triglyceride;TC:total cholesterol;LDL-C:low-density lipoprotein cholesterol; HDL-C,high-density lipoprotein cholesterol; ALT:alanine transaminase; AST:aspartate transaminase;HOMA-IR:homeostatic model assessment of insulin resistance;FBG:fasting blood glucose;BMI:body mass index;DPP-4 inhibitors:Dipeptidyl peptidase-4 inhibitors;GGT:gamma-glutamyl transpeptidase;GLP-1RAs:glucagon-like peptide-1 receptor agonists;HbA1c:hemoglobin A1c; WC:waist circumference; WHR:waist-to-hip ratio;SGLT-2:sodium-glucose cotransporter 2 inhibitor;LSM:Liver stiffness measurement;PDFF:Liver proton density fat fraction; CAP:Controlled attenuation parameter;LF:liver fat content;HIIT:high-intensity Interval Training;MICT: moderate-intensity continuous training;RT: resistance training;AMSTAR:A Measure Tool to Assess Systematic Reviews;VAT:Visceral Adipose Tissue;SAT:Subcutaneous Adipose Tissue;FIB-4 index:fibrosis 4 index;SFA:subcutaneous fat areas;ALP:Alkaline phosphatase;FLI:liver fat index;L/S:Liver-to-spleen attenuation;NAFLDFS:liver fat score;VFM:visceral fat mass;NFS:NAFLD fibrosis score;IHA:intrahepatic adipose;CI: confidence interval; NA: not available; SMD:standardised mean differences;RCTs:Randomized controlled trials;WMD:weighted mean differences;MD:mean difference;GRADE:Grades of Recommendation, Assessment, Development and Evaluation.

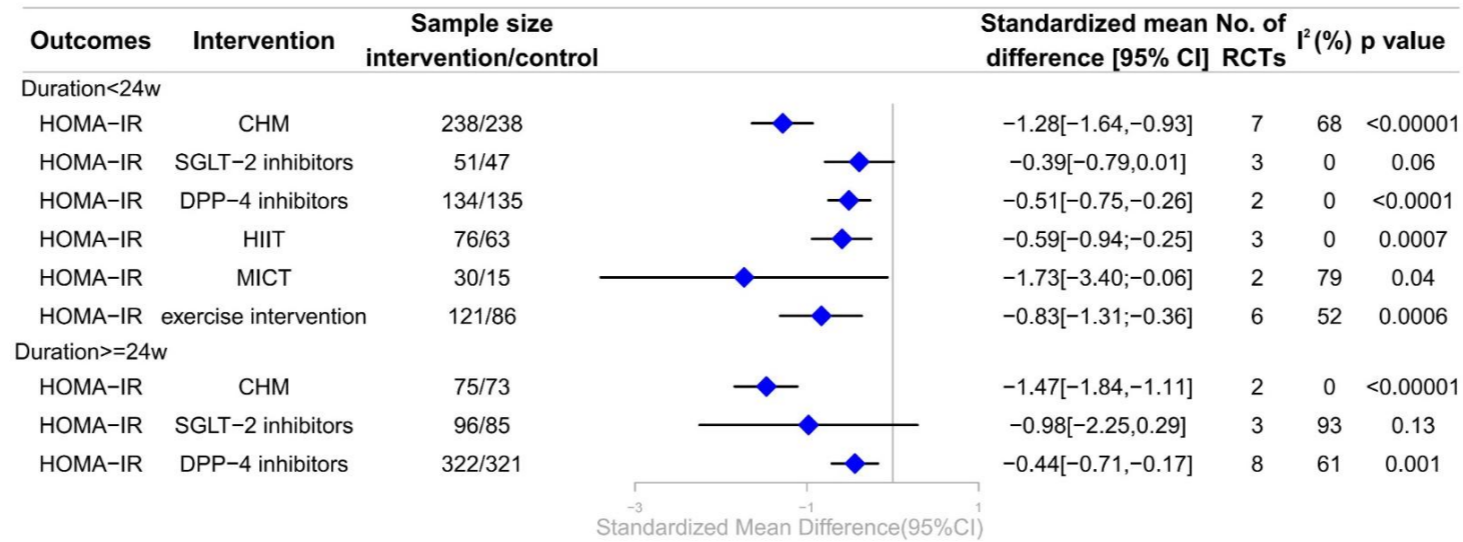


Figure S1. Subgroup analysis(A).HOMA-IR:homeostasis model assessment of insulin resistance;CHM:Chinese herbal medicine;SGLT-2 inhibitors:sodium-glucose cotransporter-2 inhibitors;DPP-4 inhibitors:dipeptidyl peptidase-4 inhibitors;HIIT:High-intensity interval training;MICT:moderate-intensity continuous training;CI:confidence intervals;RCTs:randomized controlled trials.

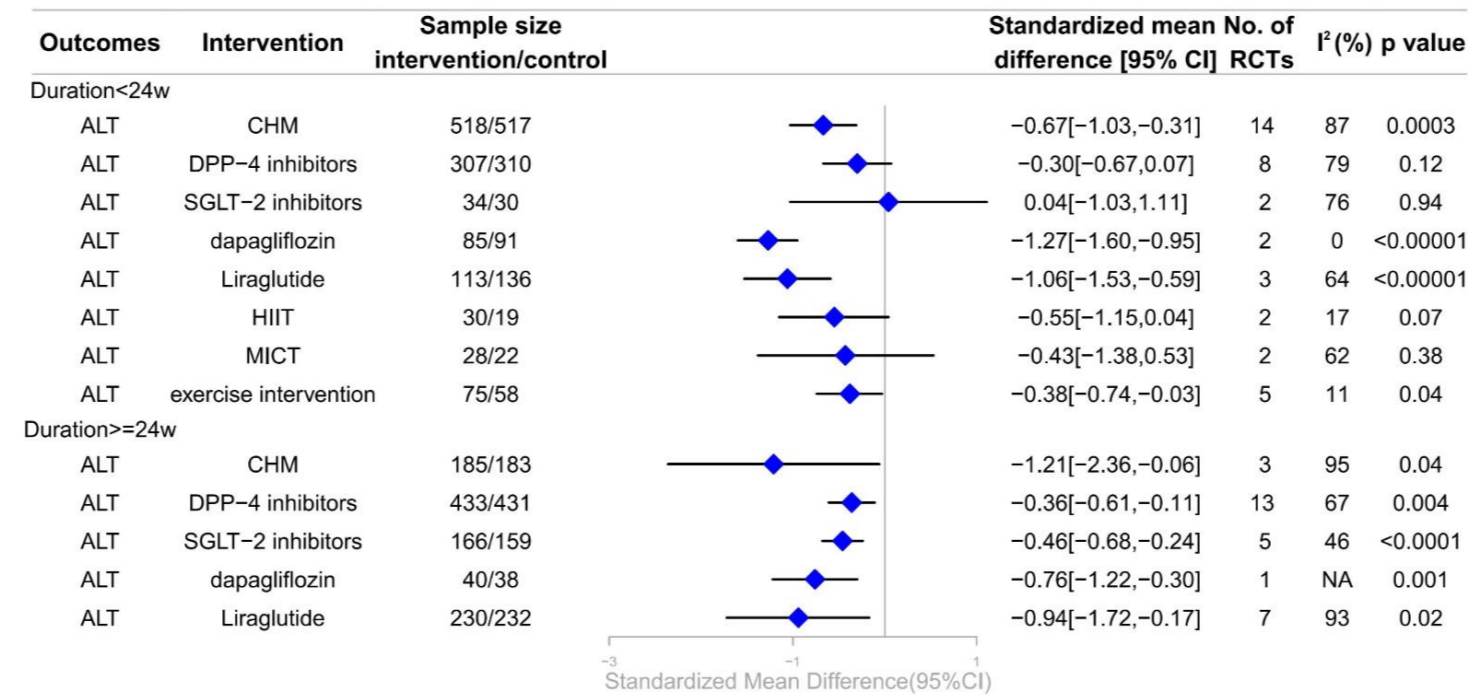


Figure S2. Subgroup analysis(B).ALT:alanine aminotransferase;CHM:Chinese herbal medicine;SGLT-2 inhibitors:sodium-glucose cotransporter -2inhibitors;DPP-4 inhibitors:dipeptidyl peptidase-4 inhibitors;HIIT:High-intensity interval training;MICT:moderate-intensity continuous training;CI: confidence intervals;RCTs:randomized controlled trials.