Search strategy:-

Search date: 14/10/2025

PubMed:

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Results: 1,097

Search fields: All fields

WOS:

("Glucagon Like Peptide 1 Receptor Agonists" OR "GLP-1 Agonists" OR "GLP 1 Agonists" OR "GLP-1 Receptor Agonists" OR "GLP 1 Receptor Agonists" OR "GLP1 Agonists" OR "GLP-1R Agonists" OR "GLP 1R Agonists" OR "GLP1R Agonists" OR "incretin Mimetics" OR "GLP-1 Analogs" OR "GLP 1 Analogs" OR exenatide OR liraglutide OR benaglutide OR beinaglutide OR lixisenatide OR dulaglutide OR loxenatide OR efinopegdutide OR semaglutide OR tirzepatide OR albiglutide) AND ("Non alcoholic Fatty Liver Disease" OR "Nonalcoholic Fatty Liver" OR "Nonalcoholic Fatty Livers" OR NAFLD OR "Nonalcoholic Fatty Liver Disease" OR "Nonalcoholic Steatohepatitis" OR "Nonalcoholic Steatohepatitides" OR "Metabolic associated fatty liver disease" OR MAFLD OR "Metabolic-dysfunction associated fatty liver disease" OR "Metabolic-dysfunction associated steatotic liver disease" OR MASLD OR "Fatty Liver" OR "Nonalcoholic Fatty Liver" OR NASH OR "Metabolic dysfunction-associated Steatohepatitis" OR MASH OR "liver fibrosis" OR "hepatic steatosis")

Results: 1,372
Search fields: Topic

Scopus :

("Glucagon Like Peptide 1 Receptor Agonists" OR "GLP-1 Agonists" OR "GLP 1 Agonists" OR "GLP-1 Receptor Agonists" OR "GLP 1 Receptor Agonists" OR "GLP1 Agonists" OR "GLP-1R Agonists" OR "GLP 1R Agonists" OR "GLP1R Agonists" OR "incretin Mimetics" OR "GLP-1 Analogs" OR "GLP 1 Analogs" OR exenatide OR liraglutide OR benaglutide OR beinaglutide OR lixisenatide OR dulaglutide OR loxenatide OR efinopegdutide OR semaglutide OR tirzepatide OR albiglutide) AND ("Non alcoholic Fatty Liver Disease" OR "Nonalcoholic Fatty Liver" OR "Nonalcoholic Fatty Livers" OR NAFLD OR "Nonalcoholic Fatty Liver Disease" OR "Nonalcoholic Steatohepatitis" OR "Nonalcoholic Steatohepatitides" OR "Metabolic associated fatty liver disease" OR MAFLD OR "Metabolic-dysfunction associated fatty liver disease" OR "Metabolic-dysfunction associated steatotic liver disease" OR MASLD OR "Fatty Liver" OR "Nonalcoholic Fatty Liver" OR NASH OR "Metabolic dysfunction-associated Steatohepatitis" OR MASH OR "liver fibrosis" OR "hepatic steatosis")

Results: 2,721
Search fields: : TITLE-ABS-KEY

Supplementary Table S1. Subgroup analysis based on the drug class

Main analysis							Sensitivity analysis (leave-one-out test)				
outcome	subgroup based on intervention	no. Of studies	Effect estimate		Heterogeneity		Exclusion of	no. Of studies	Effect estimate		Heterogeneity	
			SMD, 95%CI /RR, 95%CI	(P value)	P value	I2			SMD, 95% CI /RR, 95% CI	P value	P value	I2
resolution of MASH without worsening fibrosis	Overall population (GLP 1 agonist vs control)	6	3.03 [1.80, 5.11]	(P < 0.0001)	(P = 0.003)	I^2 = 72 %	not resolved	_				
	single agonists	4	1.91 [1.61, 2.25]	(P < 0.00001)	(P = 0.43)	I^2 = 0%	not performed since theres no significant heterogeneity	_				
	Dual or triple agonists	2	6.25 [3.31, 11.79]	(P < 0.00001)	(P = 0.51)	I^2 = 0%	not performed since theres no significant heterogeneity	_				
improvement of at least one stage of liver fbrosis without worsening of MASH	Overall population (GLP 1 agonist vs placebo)	5	1.45 [1.05, 1.99]	(P = 0.02)	(P = 0.05)	I^2 = 59 %	Loomba et al. 2023	4	1.61 [1.34, 1.93]	(P < 0.00001)	P = 0.55	I^2 = 0%
	single agonists	3	1.14 [0.66, 1.96]	(P = 0.64)	(P = 0.02)	I^2 = 75 %	Loomba et al. 2023	2	1.51 [1.20, 1.91]	(P = 0.0005)	(P = 0.28)	I^2 = 13%
	Dual or triple agonists	2	1.86 [1.31, 2.63]	(P = 0.0005)	(P = 0.81)	I^2 = 0%	not performed since theres no significant heterogeneity	_				
Weight	Overall population (GLP 1	18	-1.11 [-	(P < 0.00001)	(P < 0.00001)	I^2 = 95 %	not resolved	_				

	agonist vs control)		1.57, -0.66]									
	single agonists	14	-0.63 [-0.90, -0.37]	(P < 0.00001)	(P < 0.00001)	I^2 = 79 %	not resolved	_				
	Dual or triple agonists	4	-2.96 [-4.90, -1.02]	(P = 0.003)	(P < 0.00001)	I^2 = 98 %	not resolved	_				
HBA1c	Overall population (GLP 1 agonist vs control)	15	-0.81 [-1.16, -0.45]	(P < 0.00001)	(P < 0.00001)	I^2 = 90 %	not resolved	_				
	single agonists	12	-0.86 [-1.31, -0.41]	(P = 0.0002)	(P < 0.00001)	I^2 = 91 %	not resolved	_				
	Dual or triple agonists	3	-0.76 [-1.42, -0.10]	(P = 0.02)	(P < 0.0001)	I^2 = 90 %	Harrison et al. 2025	2	-1.13 [-1.36, -0.91]	(P < 0.00001)	(P = 0.44)	I^2 = 0%
Liver fat	Overall population (GLP 1 agonist vs control)	17	-0.72 [-0.99, -0.45]	(P < 0.00001)	(P < 0.00001)	I^2 = 78 %	not resolved	_				
	single agonists	12	-0.67 [-1.08, -0.26]	(P = 0.001)	(P < 0.00001)	I^2 = 83 %	not resolved	_				
	Dual or triple agonists	5	-0.81 [-1.07, -0.56]	(P < 0.00001)	(P = 0.10)	I^2 = 49 %	not performed since theres no significant heterogeneity	_				
AST	Overall population (GLP 1 agonist vs control)	16	-0.48 [-0.83, -0.13]	(P = 0.008)	(P < 0.00001)	I^2 = 91 %	not resolved	_				

	single agonists	13	-0.42 [-0.87, 0.03]	(P = 0.07)	(P < 0.00001)	I^2 = 92 %	not resolved	_				
	Dual or triple agonists	3	-0.82 [-1.16, -0.47]	(P < 0.00001)	(P = 0.08)	I^2 = 61 %	:oomba et al. 2024	3	-0.67 [-1.02, -0.32]	(P = 0.0002)	(P = 0.22)	I^2 = 35%
							Sanyal 2024 b	3	-0.95 [-1.26, -0.63]	(P < 0.00001)	(P = 0.17)	I^2 = 47%
ALT	Overall population (GLP 1 agonist vs control)	17	-0.54 [-0.85, -0.23]	(P = 0.0008)	(P < 0.00001)	I^2 = 89 %	not resolved	_				
	single agonists	13	-0.46 [-0.87, -0.05]	(P = 0.03)	(P < 0.00001)	I^2 = 91 %	Newsome eta l. 2021	12	-0.37 [-0.52, -0.23]	(P < 0.00001)	(P = 0.32)	I^2 = 13%
	Dual or triple agonists	4	-0.76 [-1.17, -0.35]	(P = 0.0003)	(P = 0.005)	I^2 = 77 %	Loomba et al. 2024	3	-0.59 [-0.92, -0.26]	(P = 0.0004)	(P = 0.15)	I^2 = 47%

MASH: metabolic dysfunction-associated steatohepatitis. GLP 1:Glucagon-like peptide-1 . ALT :alanine transaminase. AST: aspartate aminotransferase. SMD : Standarized mean difference. RR: Risk ratio

Supplementary Table S2. Subgroup analysis based on diabetes status

Main analysis					Sensitivity analysis (leave-one-out test)			
outcome	subgroup based on	no. Of	Effect estimate	Heterogeneity	Exclusion of	no. Of	Effect estimate	Heterogeneity

	intervention	studies	SMD, 95%CI /RR, 95%CI	(P value)	P value	I2		studies	SMD, 95% CI /RR, 95% CI	P value	P value	I2
resolution of MASH without worsening fibrosis	Overall population (GLP 1 agonist vs control)	6	3.03 [1.80, 5.11]	(P < 0.0001)	(P = 0.003)	I^2 = 72 %	not resolved	_				
	patients with T2DM	3	1.83 [1.47, 2.28]	(P < 0.00001)	(P = 0.38)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
	patients without T2DM	3	2.11 [1.63, 2.72]	(P < 0.00001)	(P = 0.80)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
Improvement of at least one stage of liver fbrosis	Overall population (GLP 1 agonist vs control)	5	1.45 [1.05, 1.99]	(P = 0.02)	(P = 0.05)	I^2 = 59 %	Loomba et al. 2023	4	1.61 [1.34, 1.93]	(P < 0.00001)	P = 0.55	I^2 = 0%
	patients with T2DM	2	1.36 [1.04, 1.78]	(P = 0.02)	(P = 0.79)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
	patients without T2DM	2	1.54 [0.75, 3.15]	(P = 0.24)	(P = 0.03)	I^2 = 78 %	not performed	_				
Weight	Overall population (GLP 1 agonist vs control)	18	-1.11 [-1.57, -0.66]	(P < 0.00001)	(P < 0.00001)	I^2 = 95 %	not resolved	_				

	patients with T2DM	8	-0.90 [-1.29, -0.50]	(P < 0.00001)	(P = 0.0002)	I^2 = 76 %	not resolved	_				
	patients without T2DM	4	-0.97 [-2.18, 0.25]	(P = 0.12)	(P < 0.00001)	I^2 = 92 %	not resolved	_				
Liver fat	Overall population (GLP 1 agonist vs control)	17	-0.72 [-0.99, -0.45]	(P < 0.00001)	(P < 0.00001)	I^2 = 78 %	not resolved	_				
	patients with T2DM	7	-0.55 [-0.77, -0.33]	(P < 0.00001)	(P = 0.73)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
	patients without T2DM	4	-0.86 [-2.24, 0.52]	(P = 0.22)	(P < 0.00001);	I^2 = 94 %	Ji et al. 2025	3	-0.18 [-0.66, 0.29]	(P = 0.45)	(P = 0.19);	I^2 = 39 %
AST	Overall population (GLP 1 agonist vs control)	16	-0.48 [-0.83, -0.13]	(P = 0.008)	(P < 0.00001);	I^2 = 91 %	not resolved	_				
	patients with T2DM	7	-0.24 [-0.46, -0.02]	(P = 0.03)	(P = 0.23)	I^2 = 26 %	not performed since there is no significant heterogeneity	_				
	patients without T2DM	2	-0.29 [-0.70, 0.13]	(P = 0.17)	(P = 0.35)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
ALT	Overall population (GLP 1 agonist vs control)	17	-0.54 [-0.85, -0.23]	(P = 0.0008)	Test for overall effect: Z =	I^2 = 89 %	not resolved	_				

					1.36 (P = 0.17)			
	patients with T2DM	7	-0.34 [-0.56, -0.12]	(P = 0.002)	(P = 0.44)	I^2 = 0%	not performed since there is no significant heterogeneity	_
	patients without T2DM	2	-0.20 [-0.62, 0.21]	(P = 0.33)	(P = 0.41)	I^2 = 0%	not performed since there is no significant heterogeneity	_

MASH: metabolic dysfunction-associated steatohepatitis. GLP 1:Glucagon-like peptide-1 . ALT :alanine transaminase. AST: aspartate aminotransferase. SMD : Standarized mean difference. RR: Risk ratio

Supplementary Table S3. Sungroup analysis based on the control group

Main analysis							Sensitivity analysis (leave-one-out test)				
outcome	subgroup based on control	no. Of studies	Effect estimate		Heterogeneity		Exclusion of	no. Of studies	Effect estimate		Heterogeneity	
			SMD, 95%CI /RR, 95%CI	(P value)	P value	I2			SMD, 95%CI /RR, 95%CI	P value	P value	I2
Weight	Overall population (GLP 1 agonist vs control)	18	-1.11 [-1.57, -0.66]	(P < 0.00001)	(P < 0.00001)	I^2 = 95%	not resolved	_				
	GLP1 agonists vs Control group (placebo)	11	-1.49 [-2.13, -0.85]	(P < 0.00001)	(P < 0.00001)	I^2 = 97%	not resolved	_				

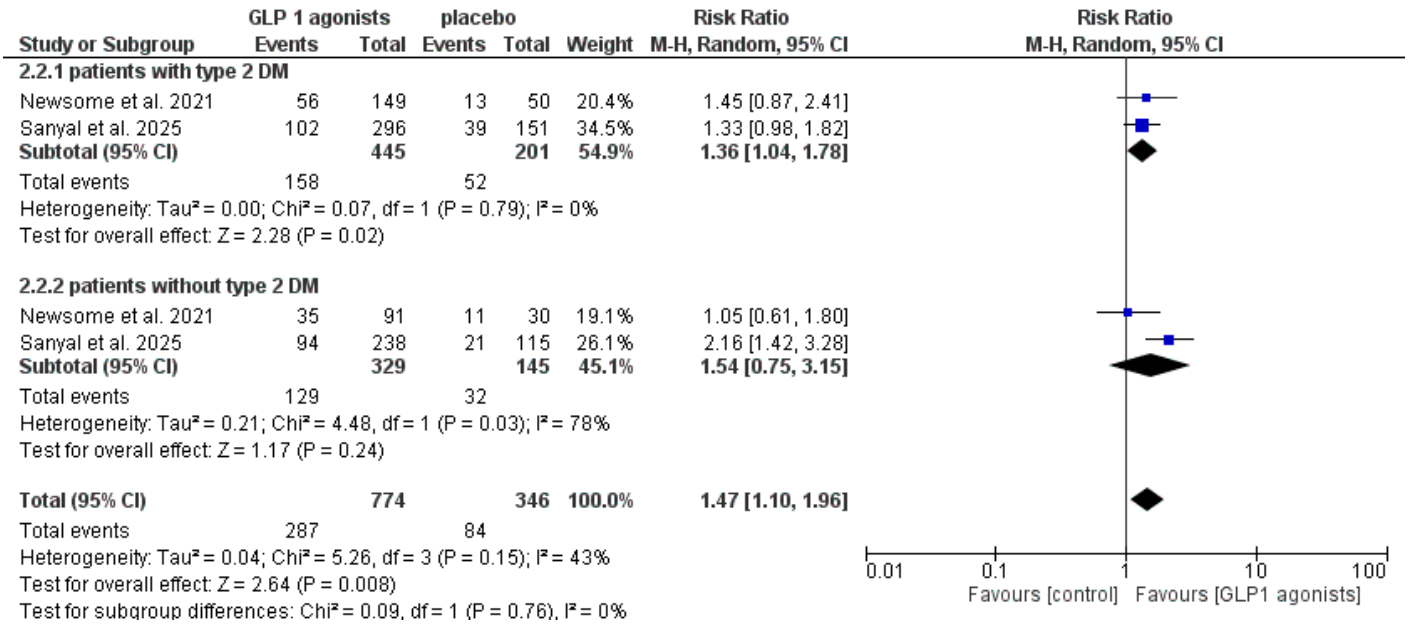
	GLP1 agonists vs Control group (insulin)	4	-0.80 [-1.13, -0.46]	(P < 0.00001)	(P = 0.27);	I^2 = 23%	not performed since there is no significant heterogeneity	_				
	GLP1 agonists vs Control group (usual care or lifestyle intervention)	4	-0.46 [-1.06, 0.14]	(P = 0.13)	(P = 0.02)	I^2 = 70%	Dutour et al. 2016	3	-0.23 [-0.81, 0.35]	(P = 0.43)	(P = 0.10);	I^2 = 56%
HBA1c	Overall population (GLP 1 agonist vs control)	15	-0.81 [-1.16, -0.45]	(P < 0.00001)	(P < 0.00001)	I^2 = 90%	not resolved	_				
	GLP1 agonists vs Control group (placebo)	10	-1.14 [-1.59, -0.68]	(P < 0.00001)	(P < 0.00001)	I^2 = 92%	not resolved	_				
	GLP1 agonists vs Control group (insulin)	4	-0.28 [-0.56, -0.00]	(P = 0.05)	(P = 0.86)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
	GLP1 agonists vs Control group (usual care or lifestyle intervention)	2	-0.16 [-0.56, 0.24]	(P = 0.44)	(P = 0.47)	I^2 = 0%	not performed since there is no significant heterogeneity	_				
Liver fat	Overall population (GLP 1 agonist vs control)	17	-0.72 [-0.99, -0.45]	(P < 0.00001)	(P < 0.00001)	I^2 = 78%	not resolved	_				
	GLP1 agonists vs Control group (placebo)	10	-1.00 [-1.42, -0.57]	(P < 0.00001)	(P < 0.00001)	I^2 = 88%	not resolved	_				

	GLP1 agonists vs Control group (insulin)	4	-0.58 [-0.87, -0.30]	(P < 0.0001)	(P = 0.93)	I^2 = 0%	not performed since there is no significant heterogeneity	_
	GLP1 agonists vs Control group (usual care or lifestyle intervention)	4	-0.34 [-0.80, 0.11]	(P = 0.14)	(P = 0.12)	I^2 = 49%	not performed since there is no significant heterogeneity	_
AST	Overall population (GLP 1 agonist vs control)	16	-0.48 [-0.83, -0.13]	(P = 0.008)	(P < 0.00001);	I^2 = 91%	not resolved	_
	GLP1 agonists vs Control group (placebo)	9	-0.76 [-1.24, -0.27]	(P = 0.002)	(P < 0.00001)	I^2 = 94%	not resolved	_
	GLP1 agonists vs Control group (insulin)	4	-0.26 [-0.63, 0.12]	(P = 0.18)	(P = 0.16)	I^2 = 41%	not performed since there is no significant heterogeneity	_
	GLP1 agonists vs Control group (usual care or lifestyle intervention)	4	-0.02 [-0.41, 0.38]	(P = 0.94)	(P = 0.20)	I^2 = 35%	not performed since there is no significant heterogeneity	_
ALT	Overall population (GLP 1 agonist vs control)	17	-0.54 [-0.85, -0.23]	(P = 0.0008)	(P < 0.00001)	I^2 = 89%	not resolved	_
	GLP1 agonists vs Control group (placebo)	10	-0.72 [-1.15, -0.29]	(P = 0.001)	(P < 0.00001)	I^2 = 93%	not resolved	_

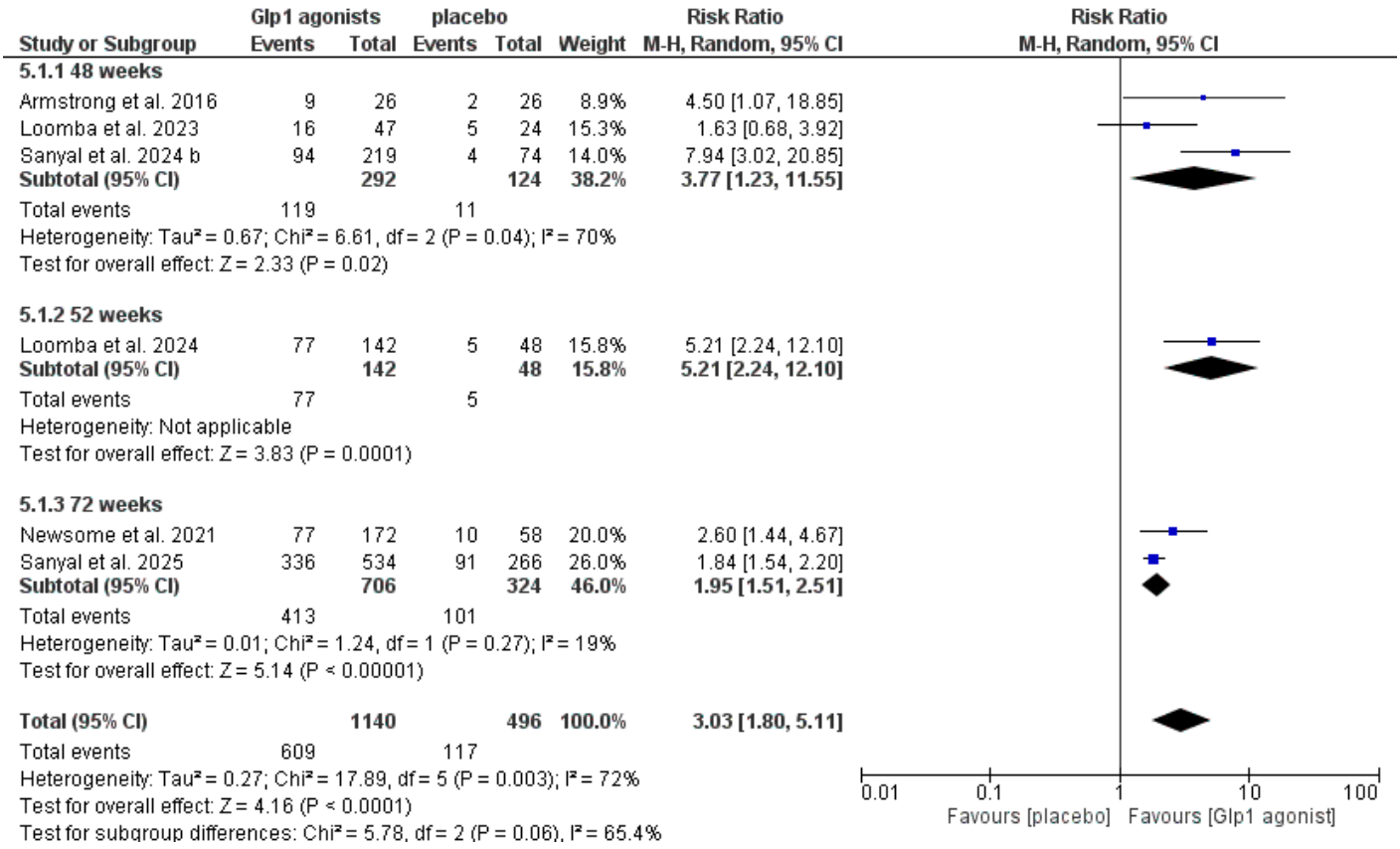
	GLP1 agonists vs Control group (insulin)	4	-0.52 [-0.79, -0.26]	(P = 0.0001)	(P = 0.75)	I^2 = 0%	not performed since there is no significant heterogeneity	_
	GLP1 agonists vs Control group (usual care or lifestyle intervention)	4	-0.08 [-0.42, 0.26]	(P = 0.66)	(P = 0.33)	I^2 = 12%	not performed since there is no significant heterogeneity	_

MASH: metabolic dysfunction-associated steatohepatitis. GLP 1:Glucagon-like peptide-1 . ALT :alanine transaminase. AST: aspartate aminotransferase. SMD : Standarized mean difference. RR: Risk ratio

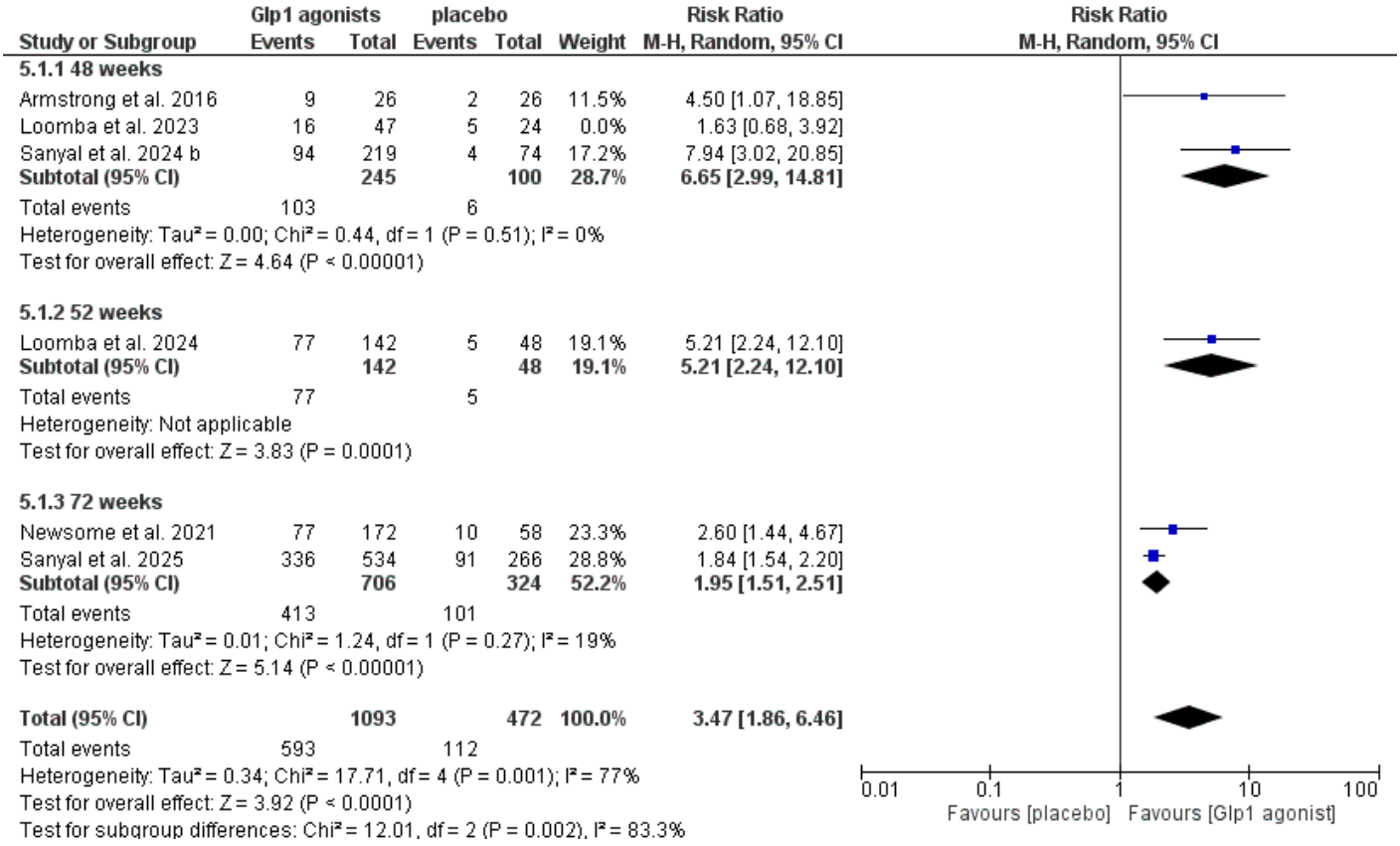
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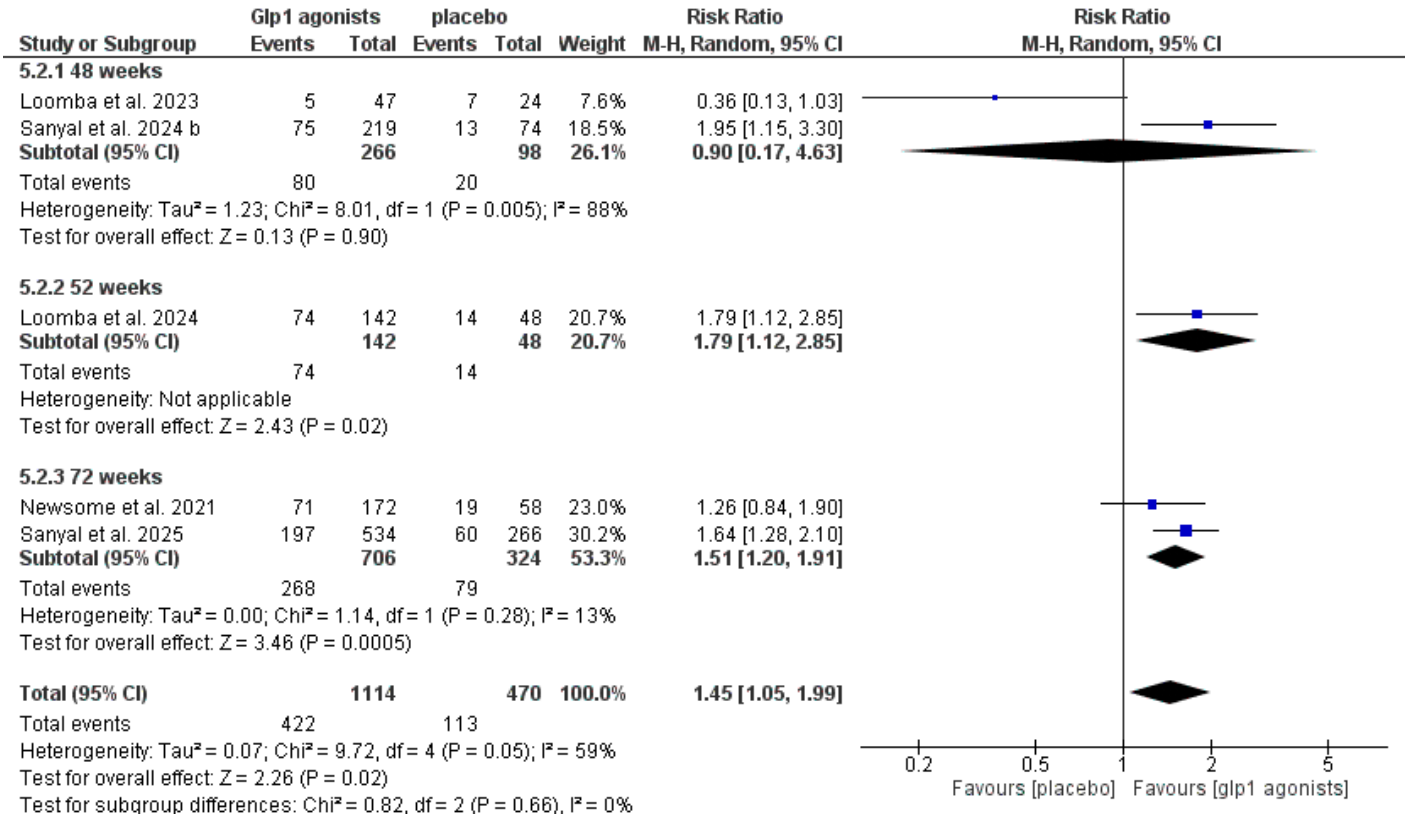
Supplementary Figure S1. Forest plot of improvement of at least one stage of liver fibrosis without worsening of MASH in patients with and without type 2 diabetes.



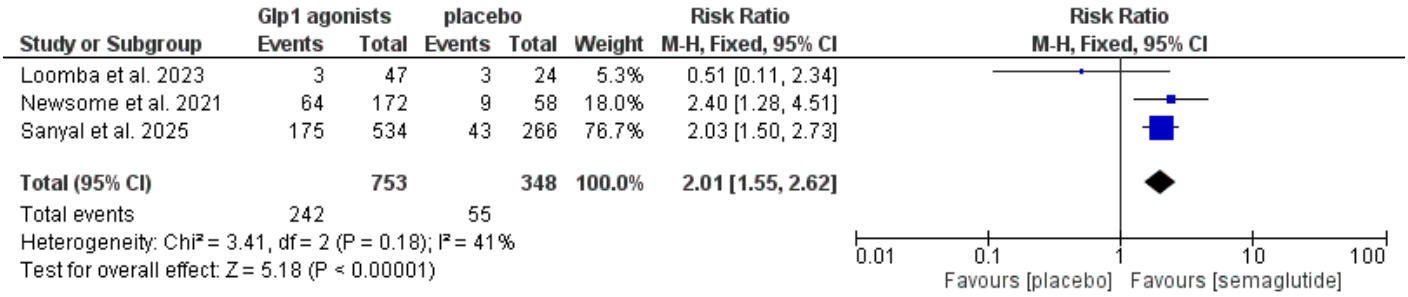
Supplementary Figure S2. Forest plot showing subgroup analysis based on treatment duration in the resolution of AMSH without worsening of fibrosis outcome.



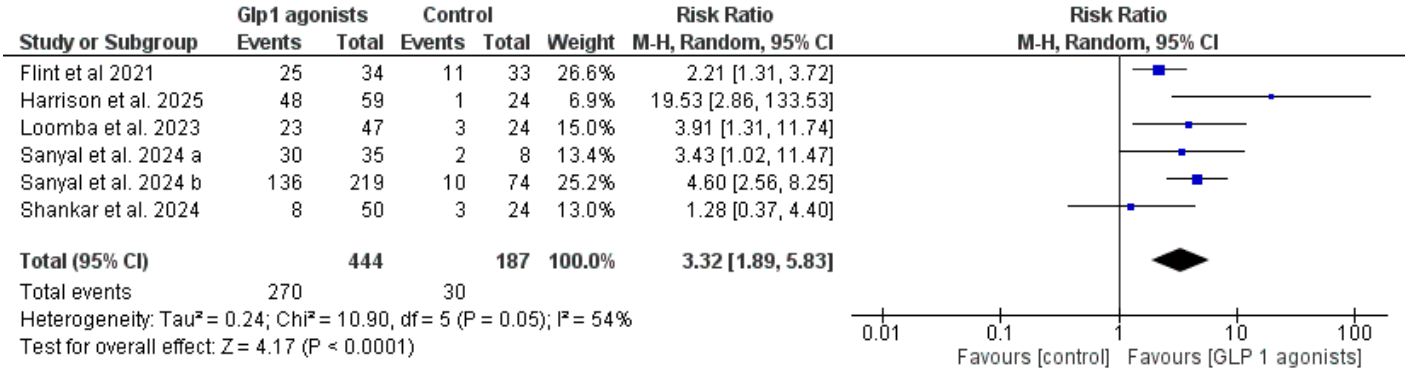
Supplementary Figure S3. Forest plot showing subgroup analysis based on treatment duration in the resolution of AMSH without worsening of fibrosis outcome after excluding Loomba et al. 2023.



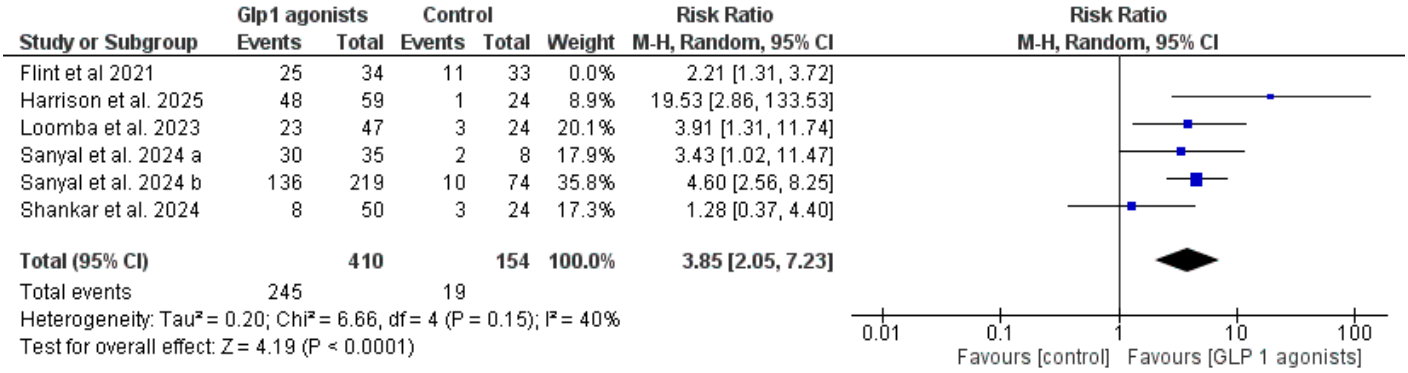
Supplementary Figure S4. Forest plot showing subgroup analysis based on treatment duration in improvement of at least one stage of liver fibrosis without worsening of MASH outcome .



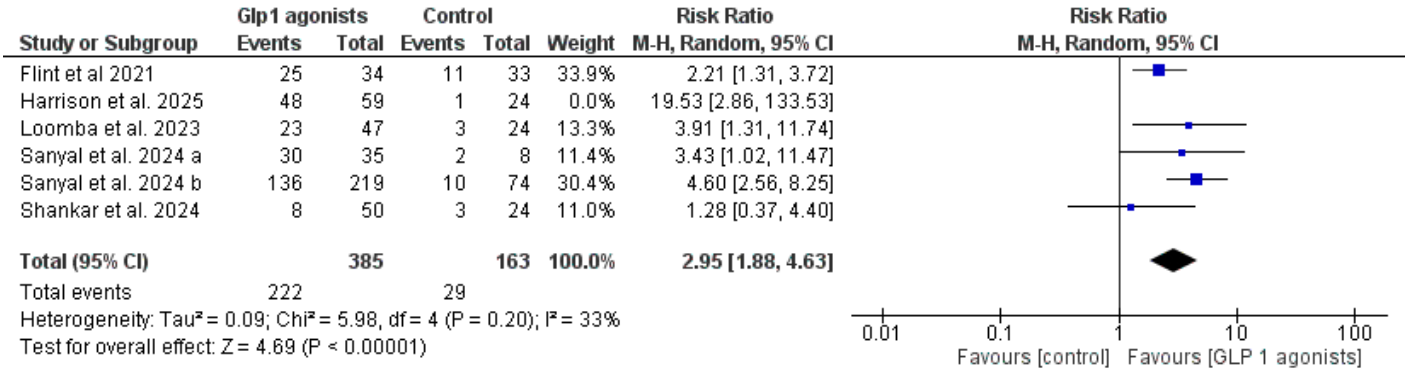
Supplementary Figure S5. Forest plot of resolution of MASH and improvement in fibrosis



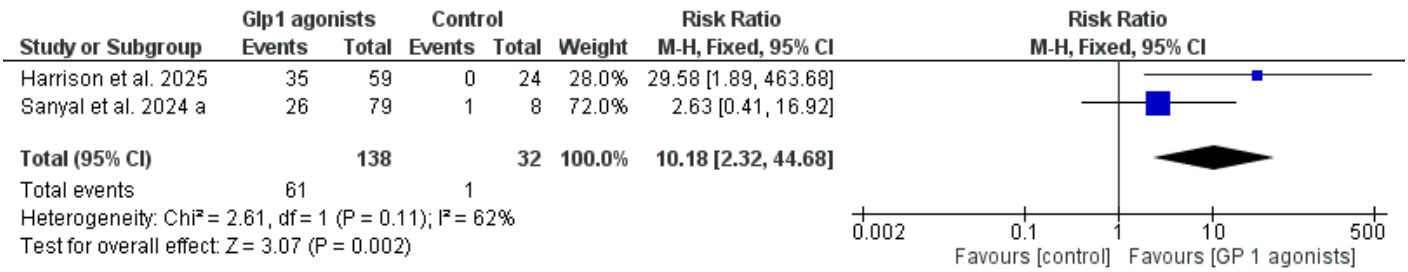
Supplementary Figure S6. Forest plot of patients with liver fat reduction ≥30%.



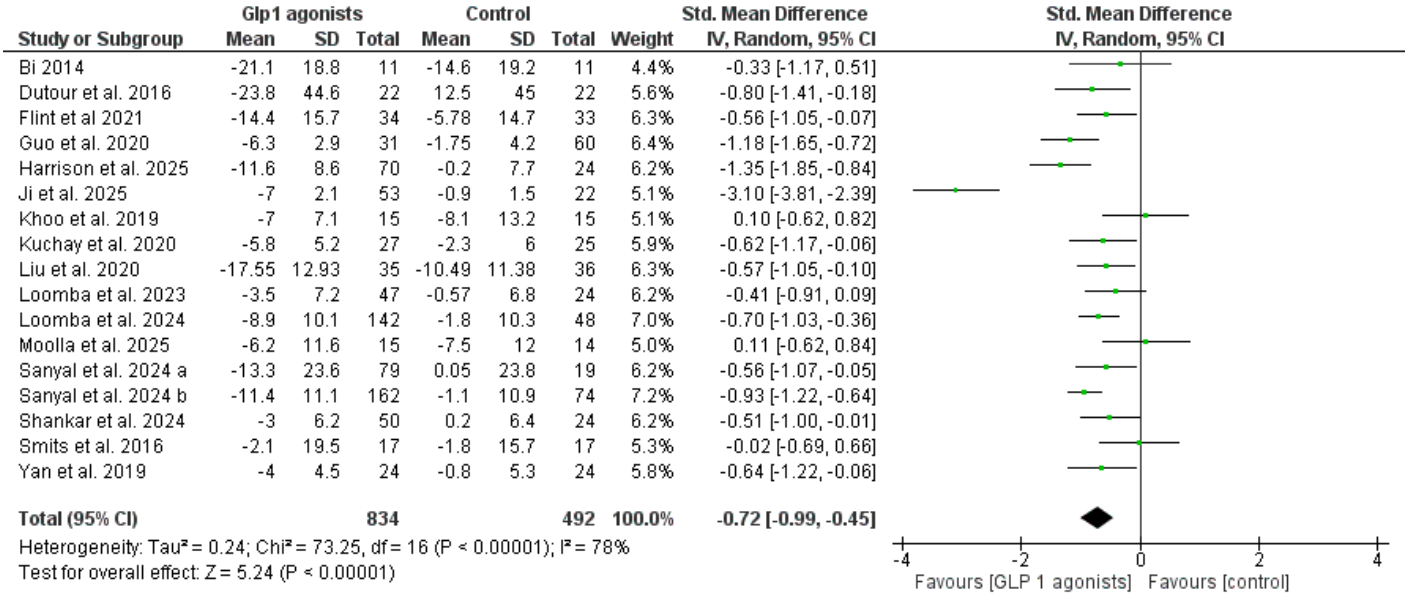
Supplementary Figure S7. Forest plot of patients with liver fat reduction ≥30% after excluding Flint et al. 2021



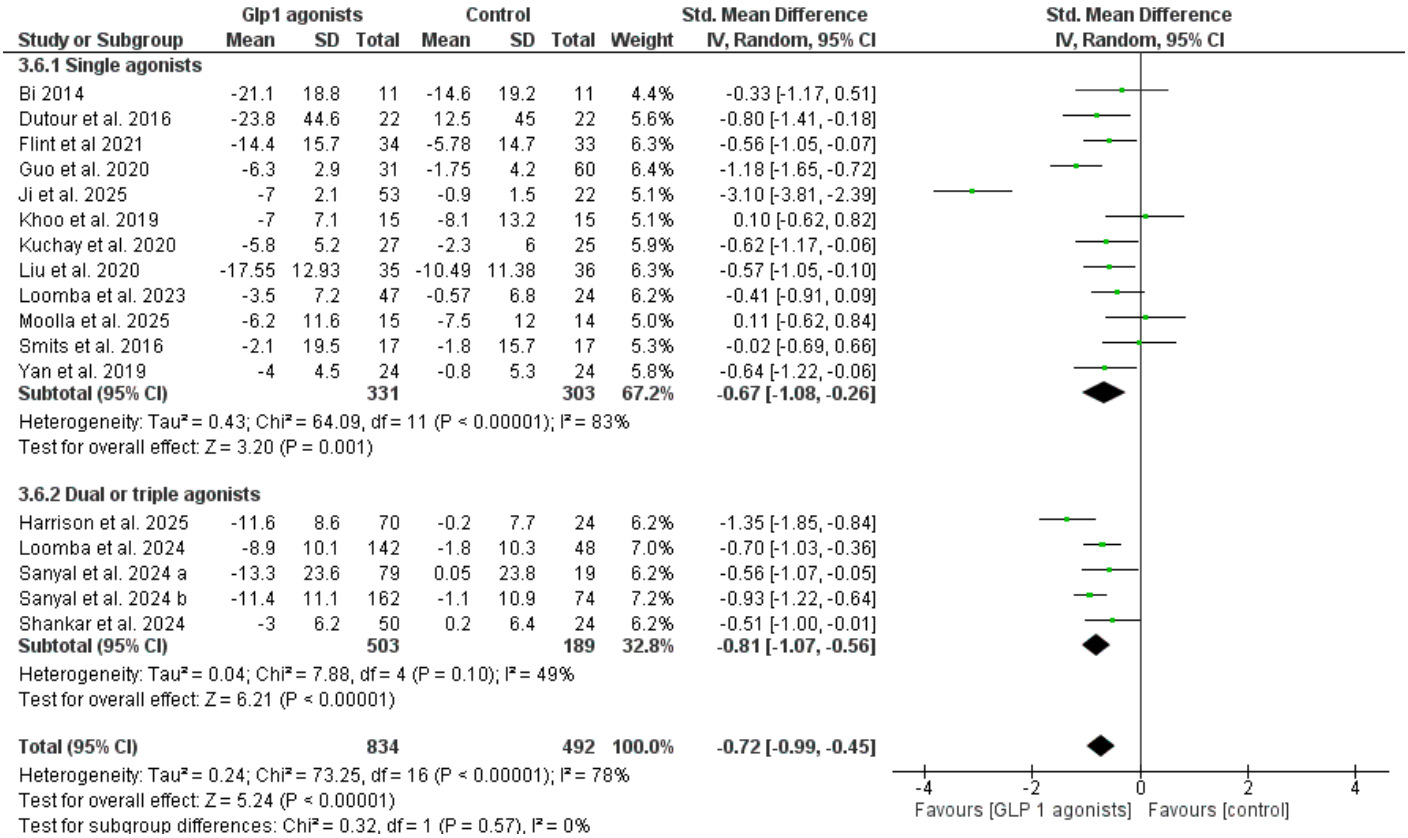
Supplementary Figure S8. Forest plot of patients with liver fat reduction ≥30% after excluding Harrison et al. 2025.



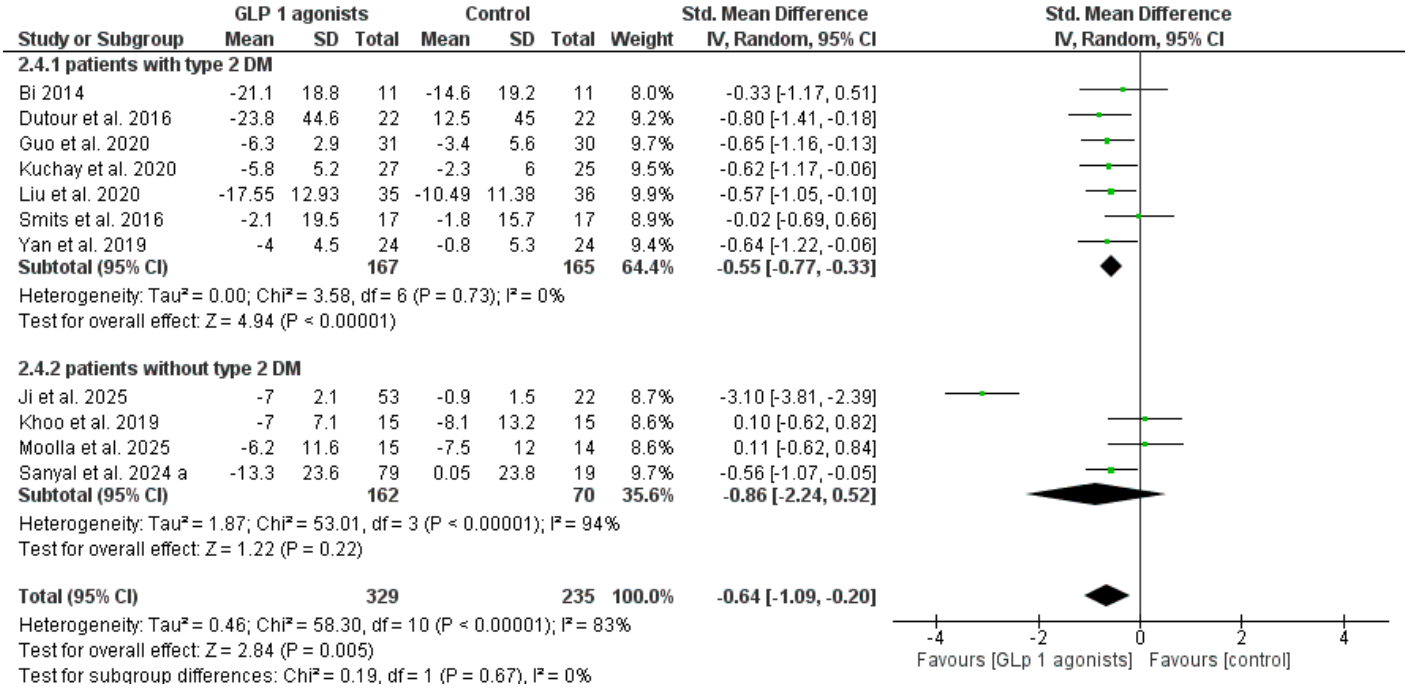
Supplementary Figure S9. Forest plot of patients with liver fat reduction ≥70% .



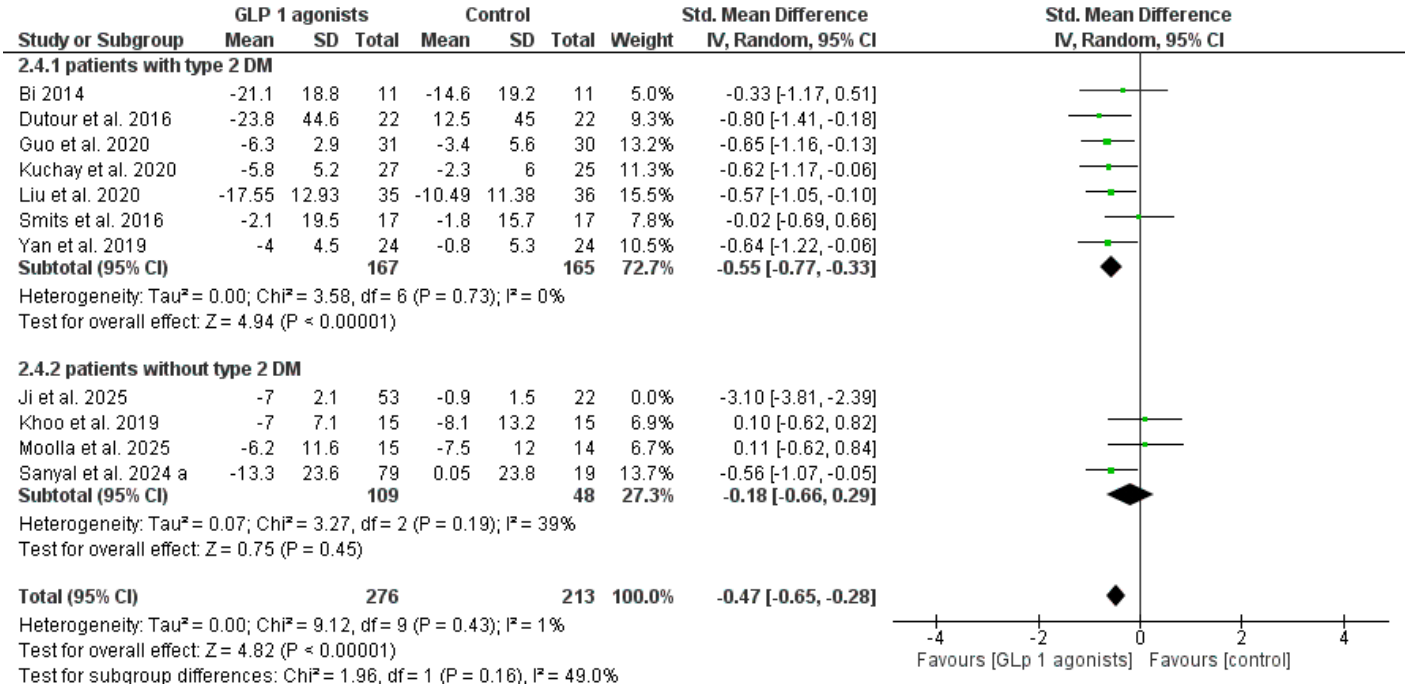
Supplementary Figure S10. Forest plot of liver fat content in the overall population .



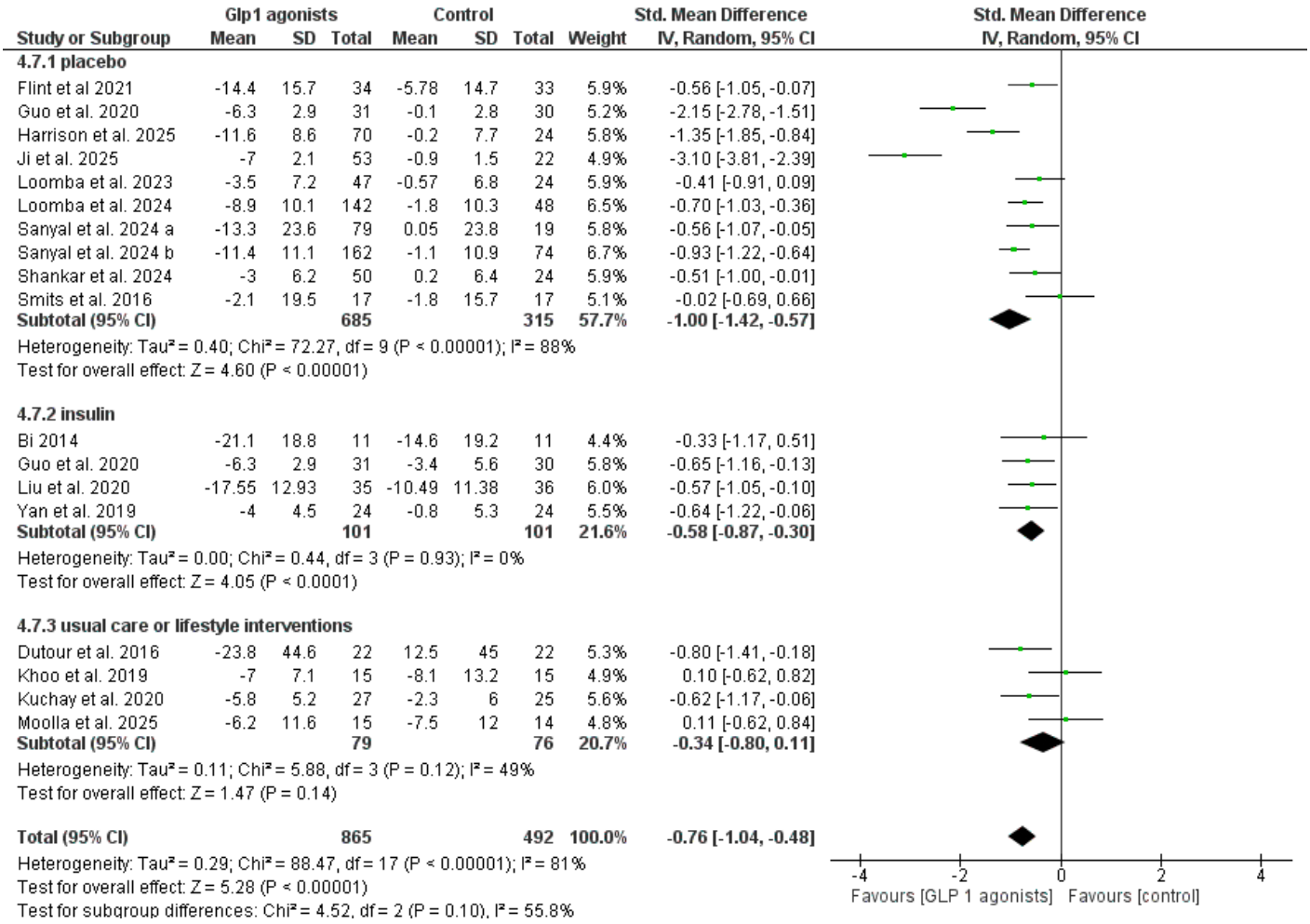
Supplementary Figure S11. Forest plot of liver fat content in patients receiving single or dual or triple agonists.



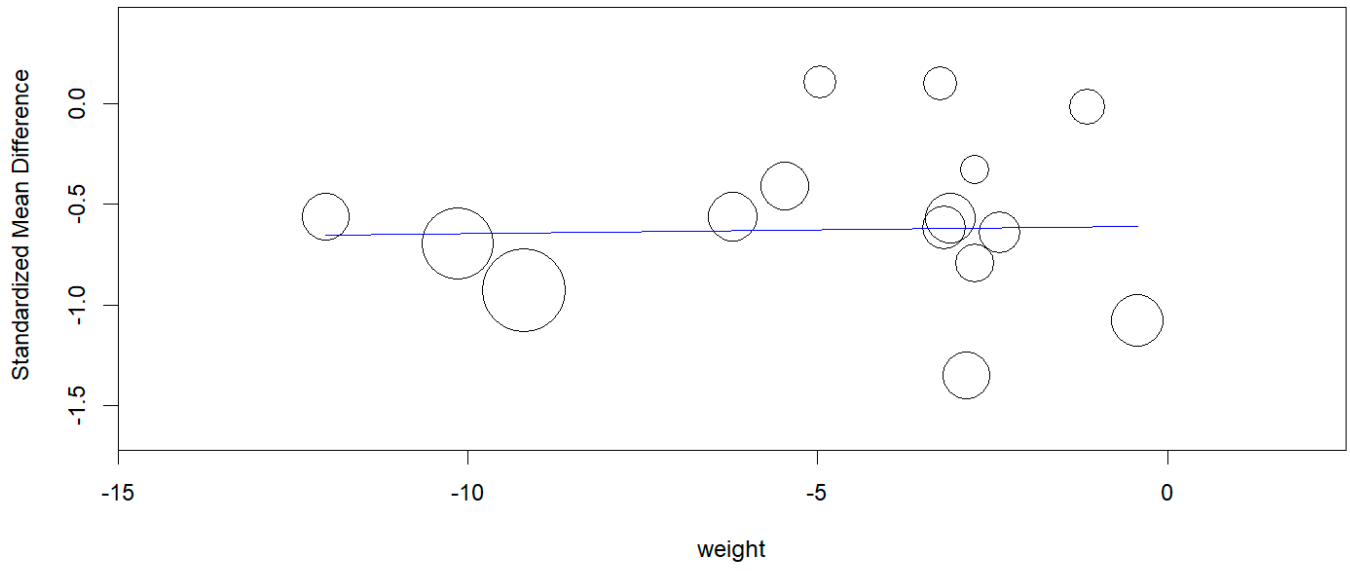
Supplementary Figure S12. Forest plot of liver fat content in patients with and without type 2 diabetes.



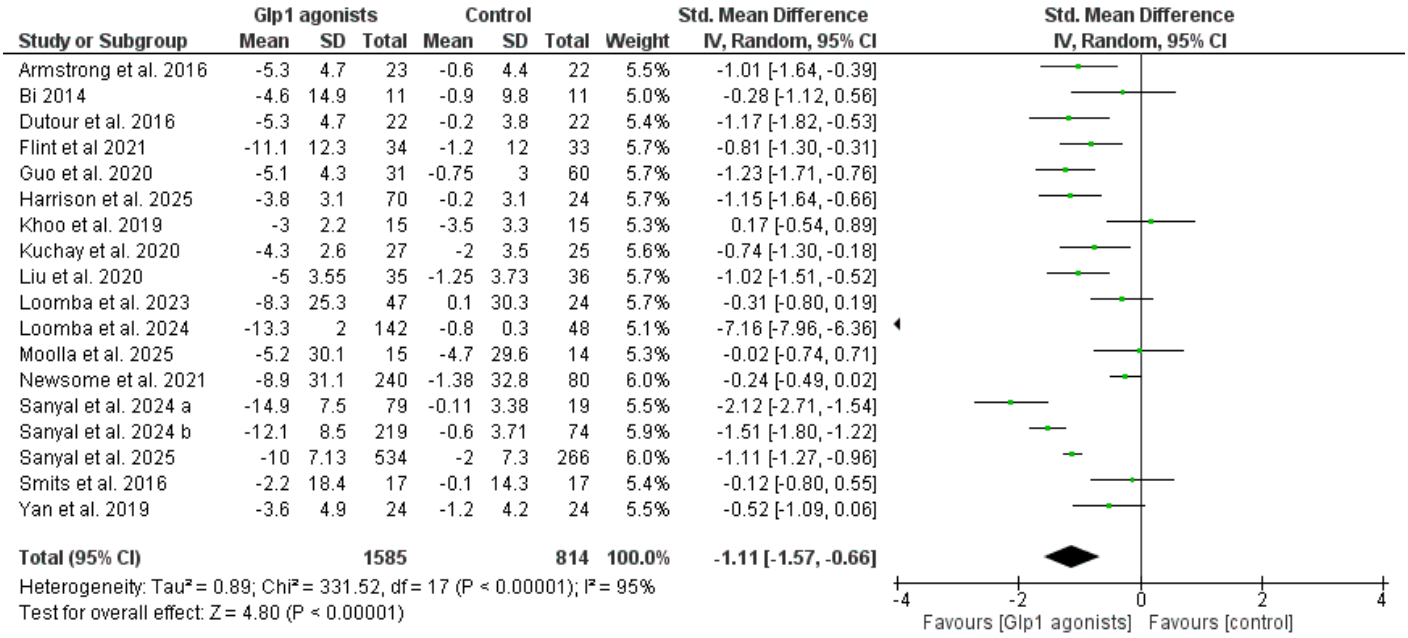
Supplementary Figure S13. Forest plot of liver fat content in patients with and without type 2 diabetes after leaving Ji et al.



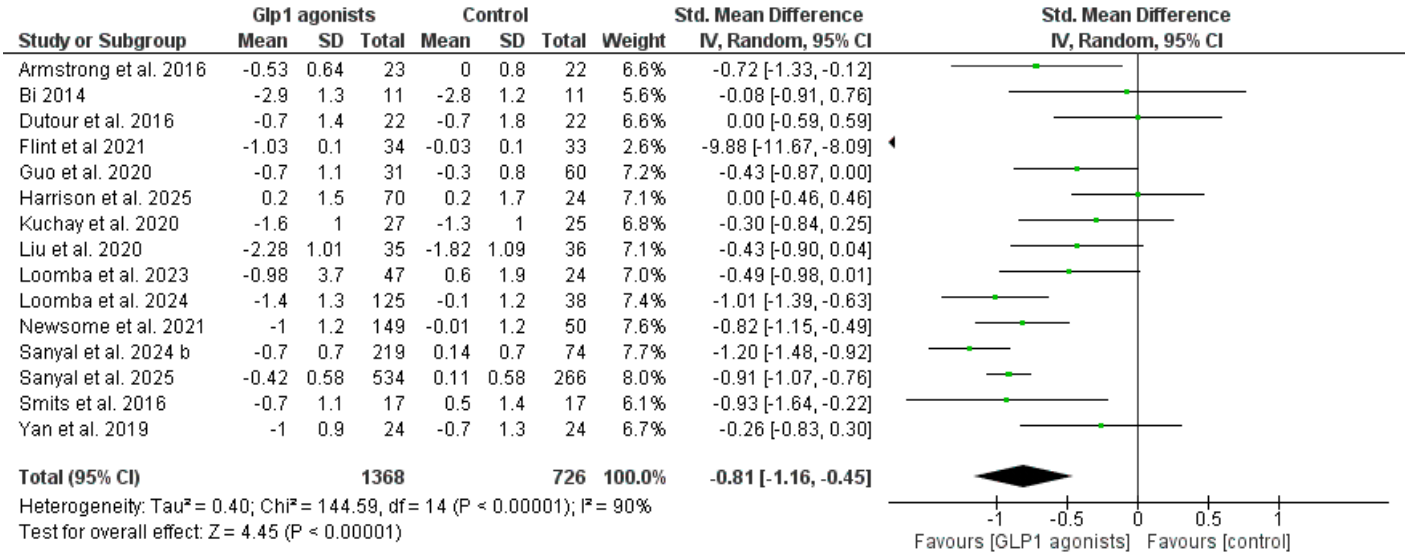
Supplementary Figure S14. Forest plot of liver fat content in based on the control group.



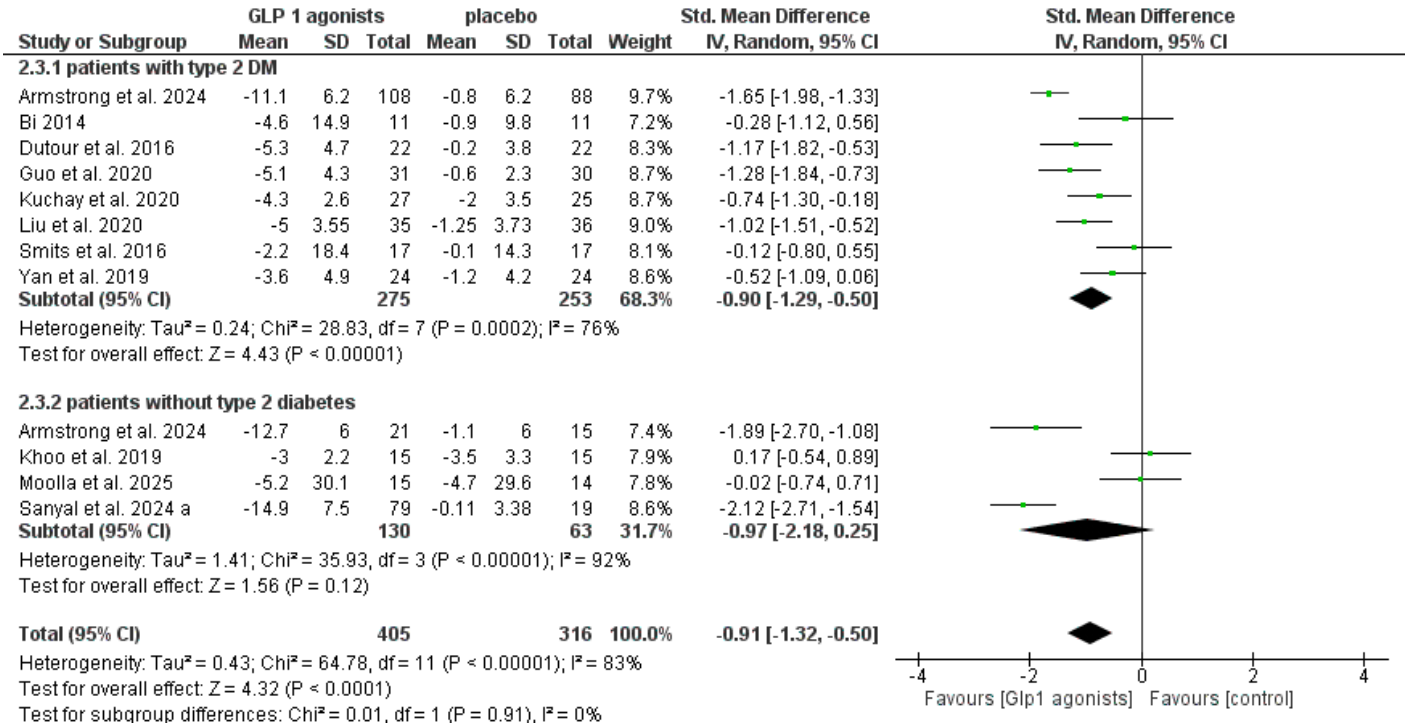
Supplementary Figure S15. Meta-regression showing no significant association between weight reduction and GLP-1 agonists reduction of liver fat content.



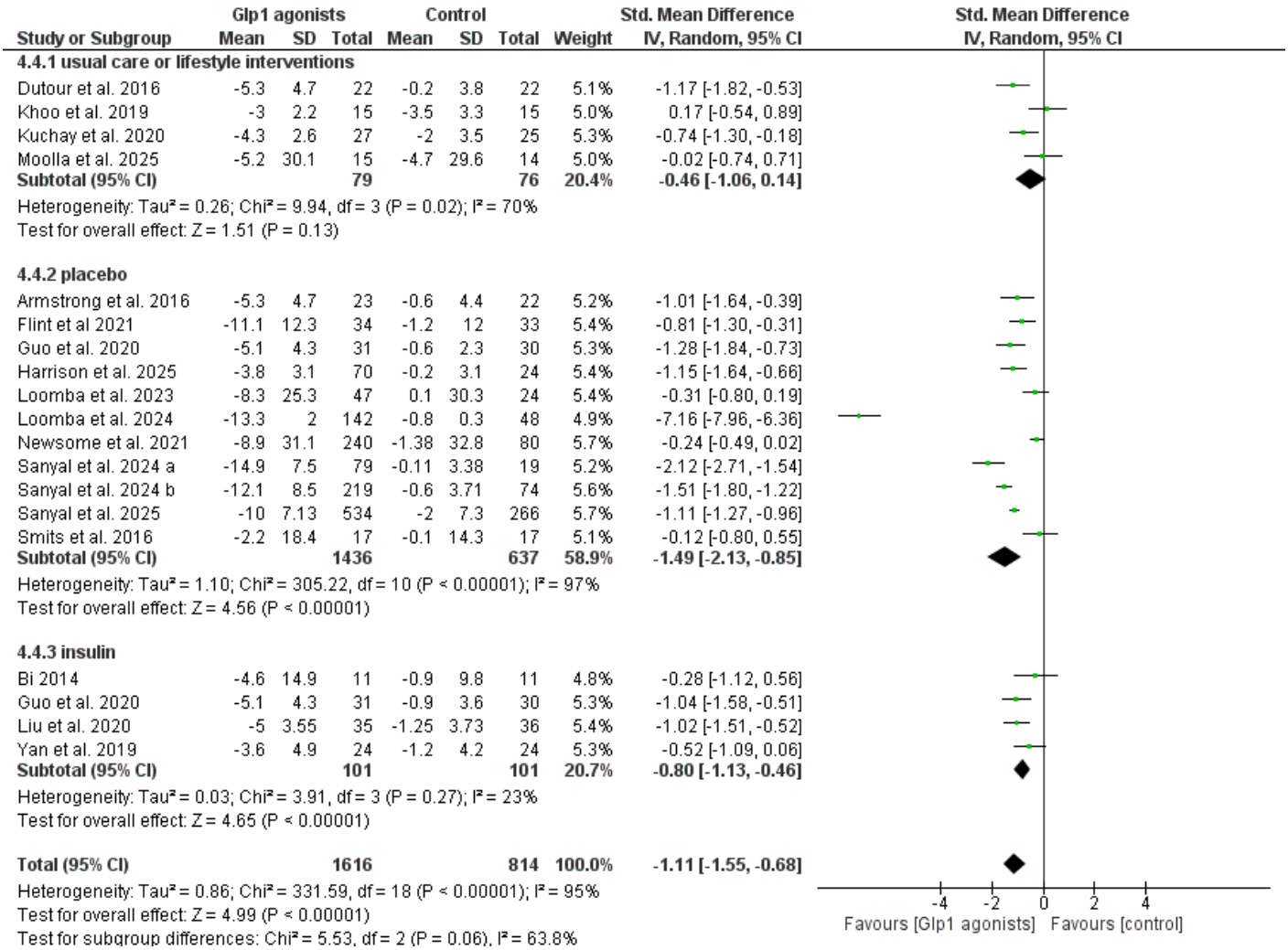
Supplementary Figure S16. Forest plot of change in weight in the overall population.



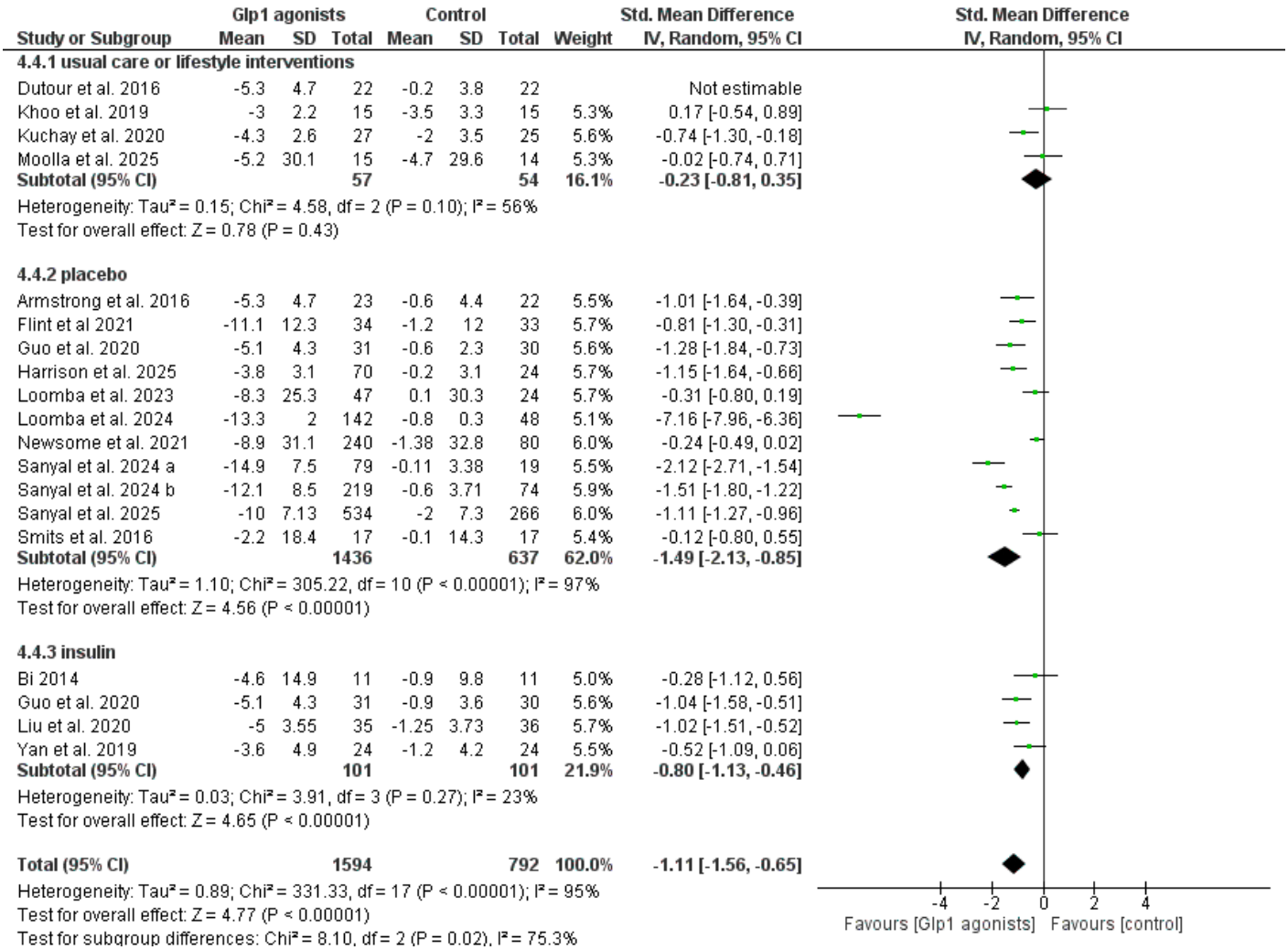
Supplementary Figure S17. Forest plot of change in HbA1c in the overall population.



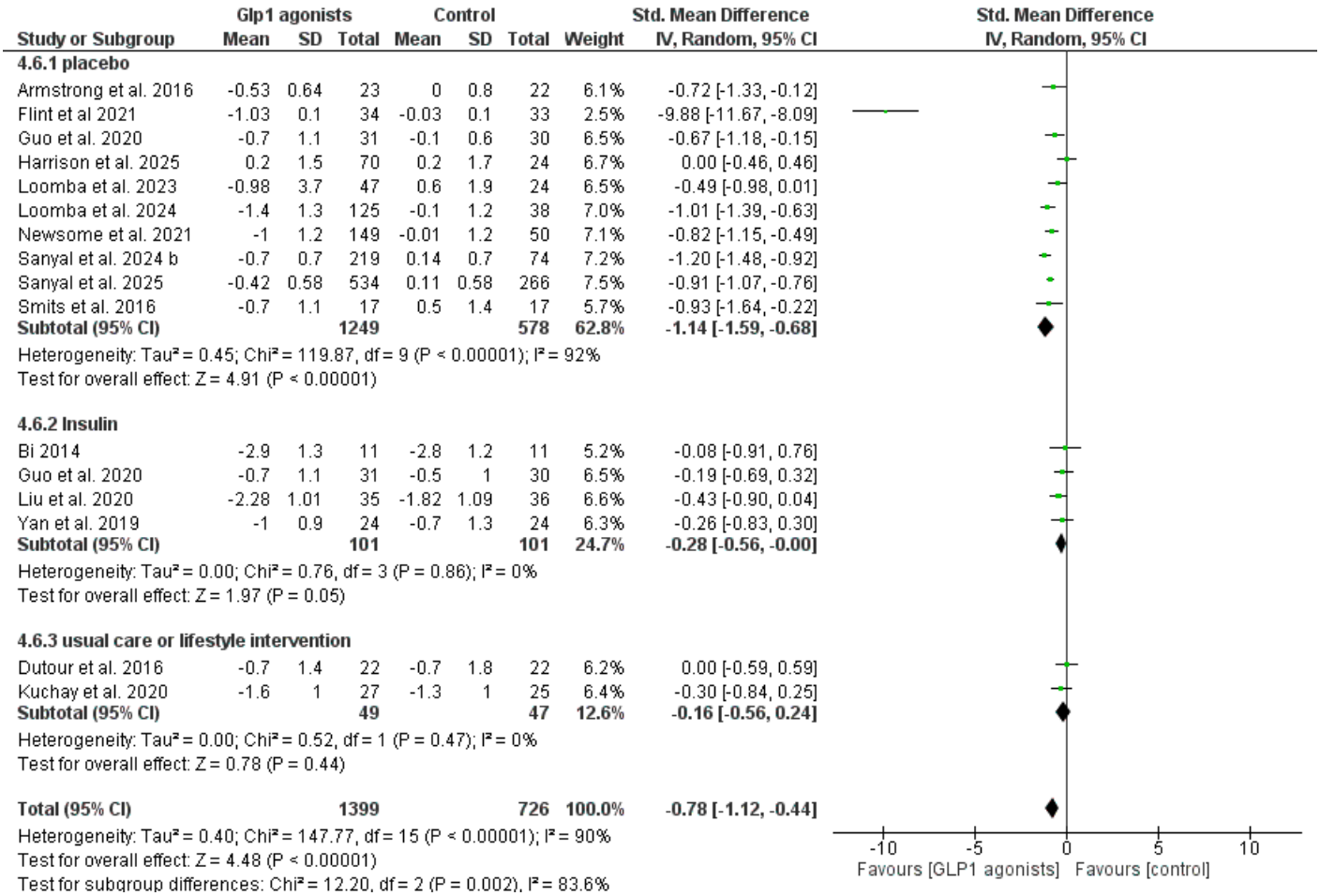
Supplementary Figure S18. Forest plot of change in weight in patients with and without type 2 diabetes.



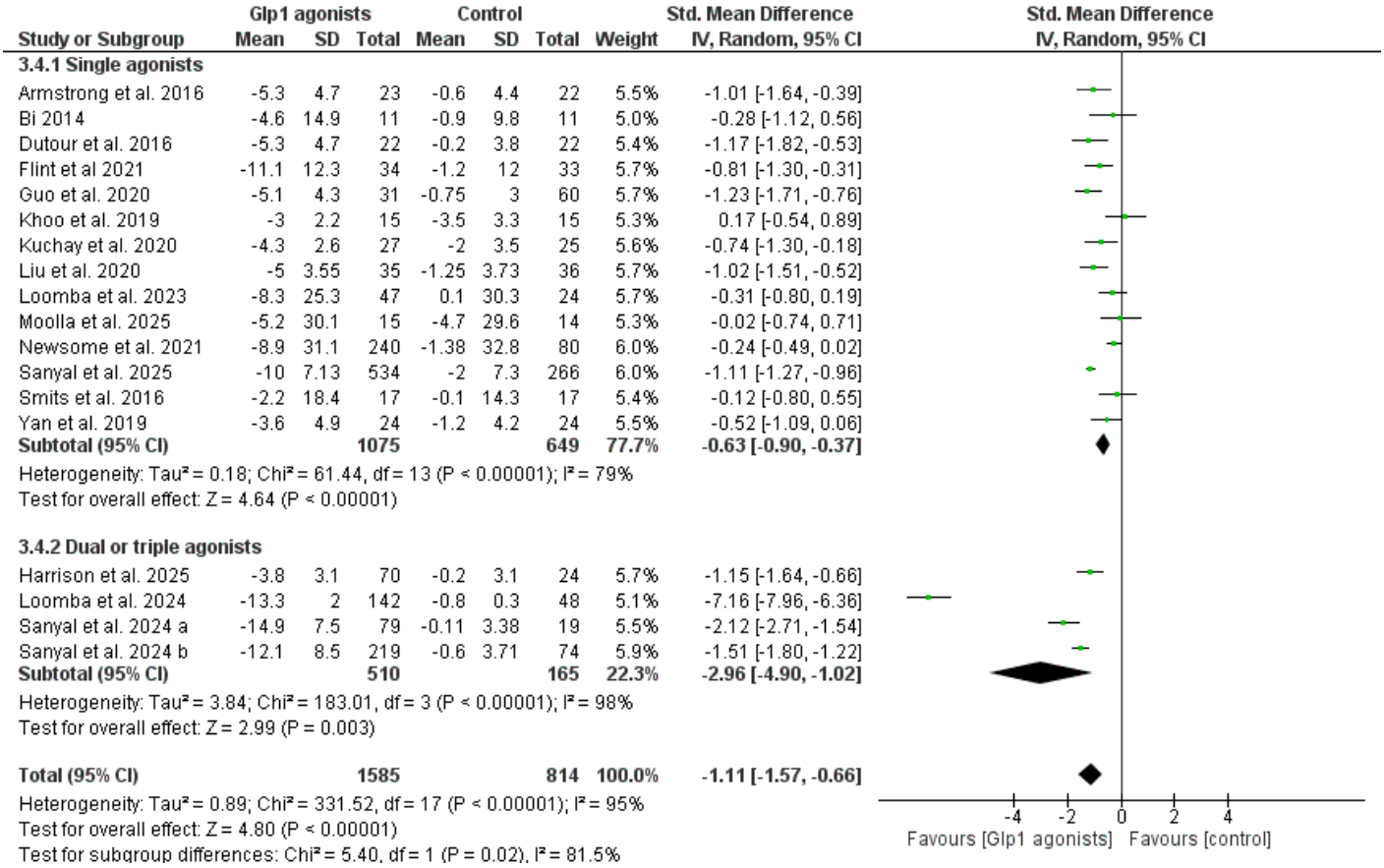
Supplementary Figure S19. Forest plot of change in weight based on the control group.



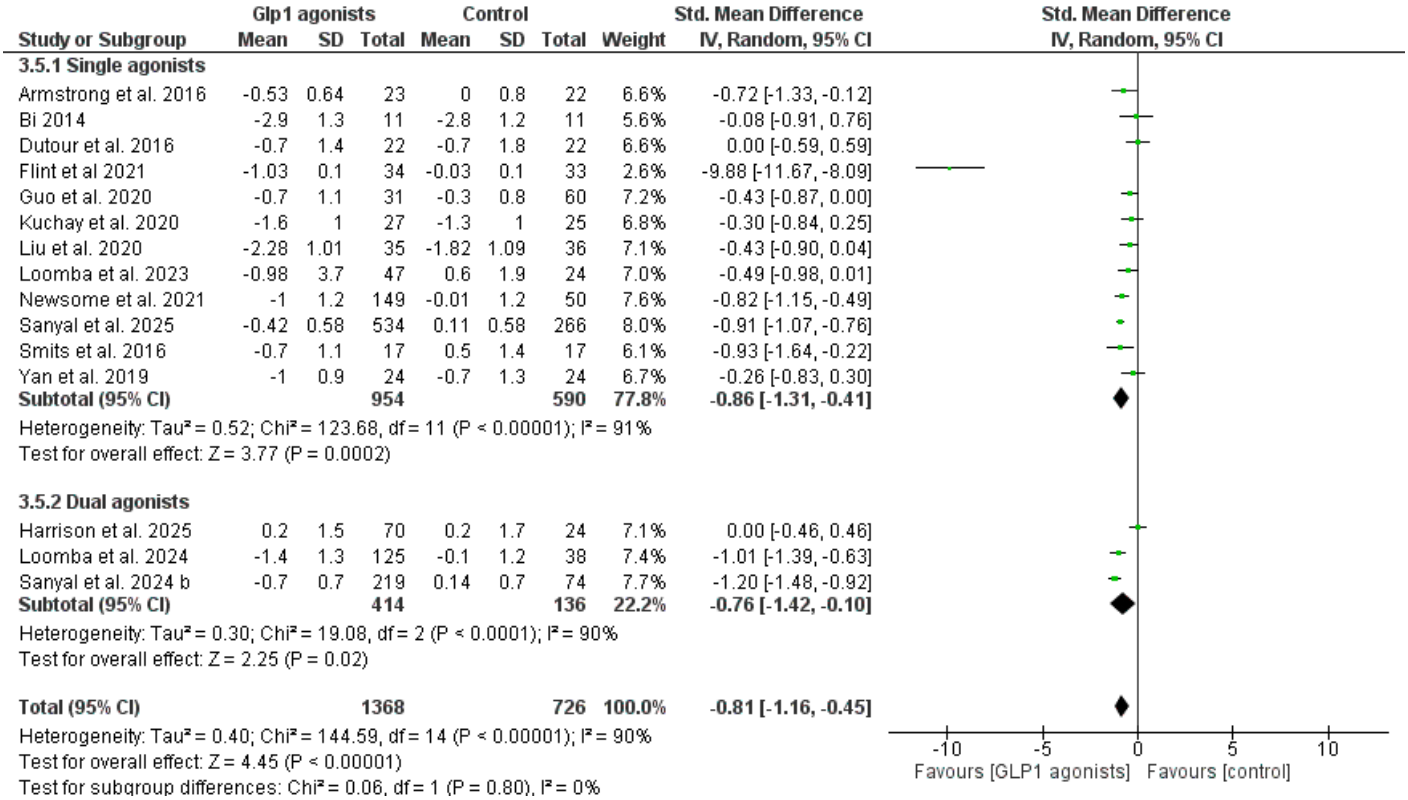
Supplementary Figure S20. Forest plot of change in weight based on the control group after leaving Dutour et al.



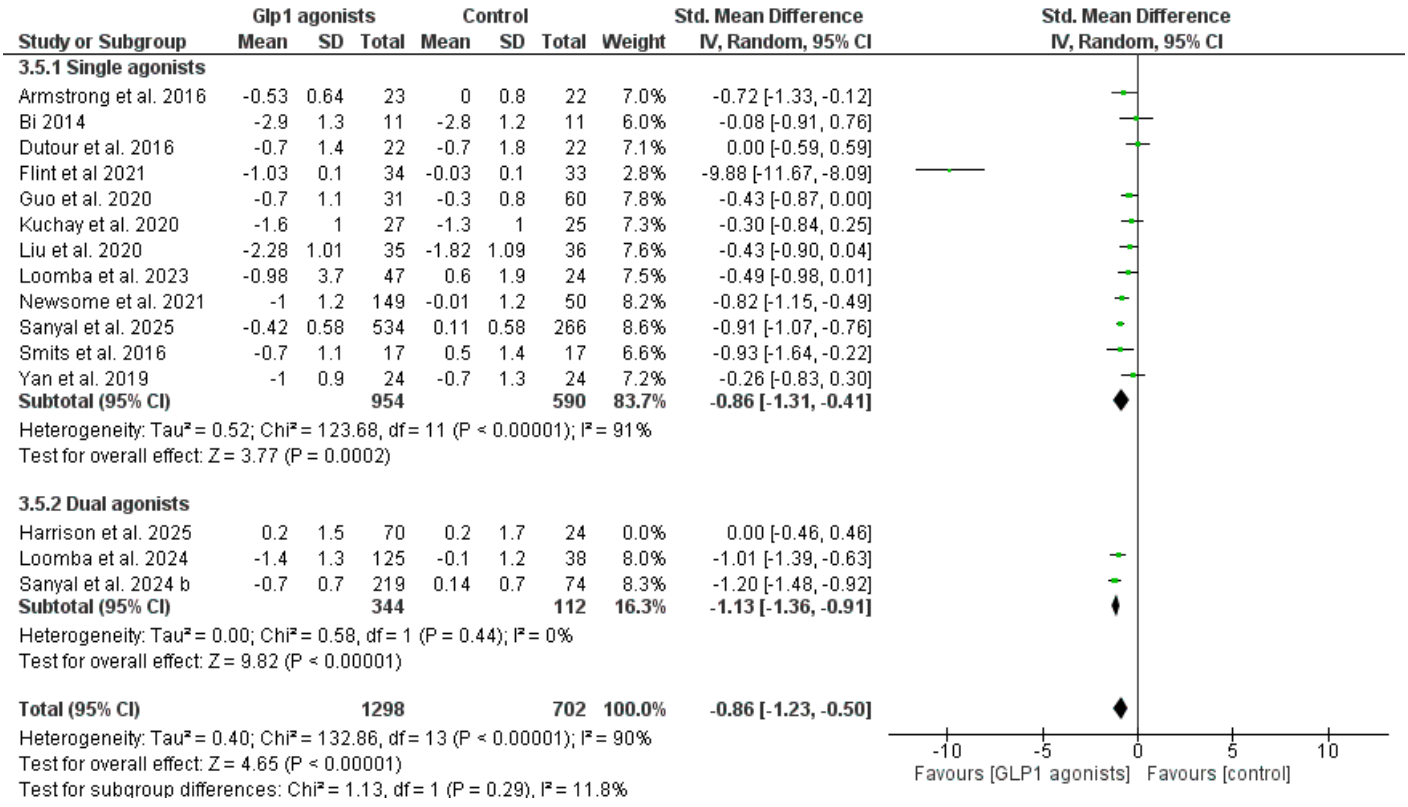
Supplementary Figure S21. Forest plot of change in HbA1c based on the control group.



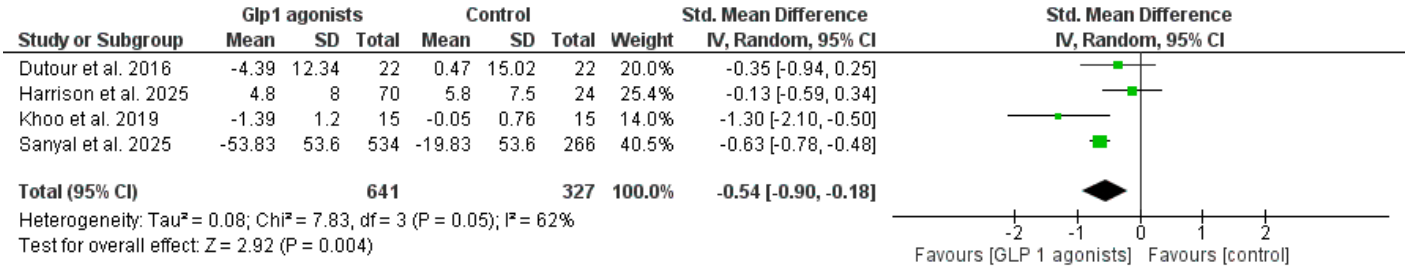
Supplementary Figure S22. Forest plot of change in weight based on the intervention group (single, or dual or triple agonists).



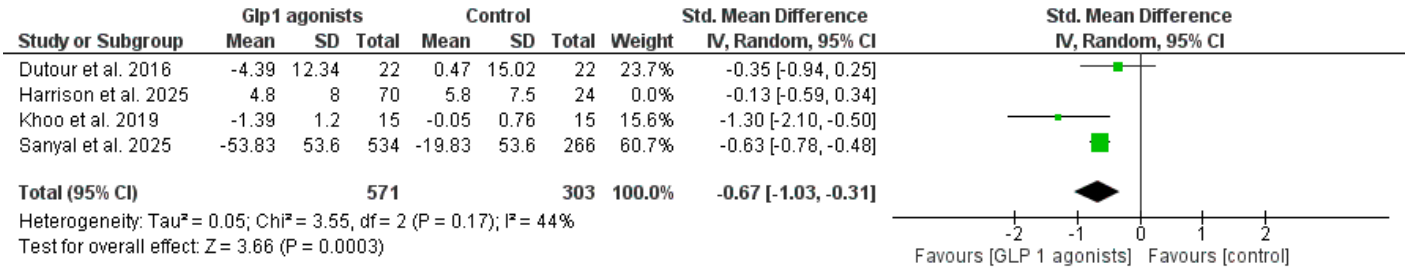
Supplementary Figure S23. Forest plot of change in HbA1c based on the intervention group (single, or dual or triple agonists).



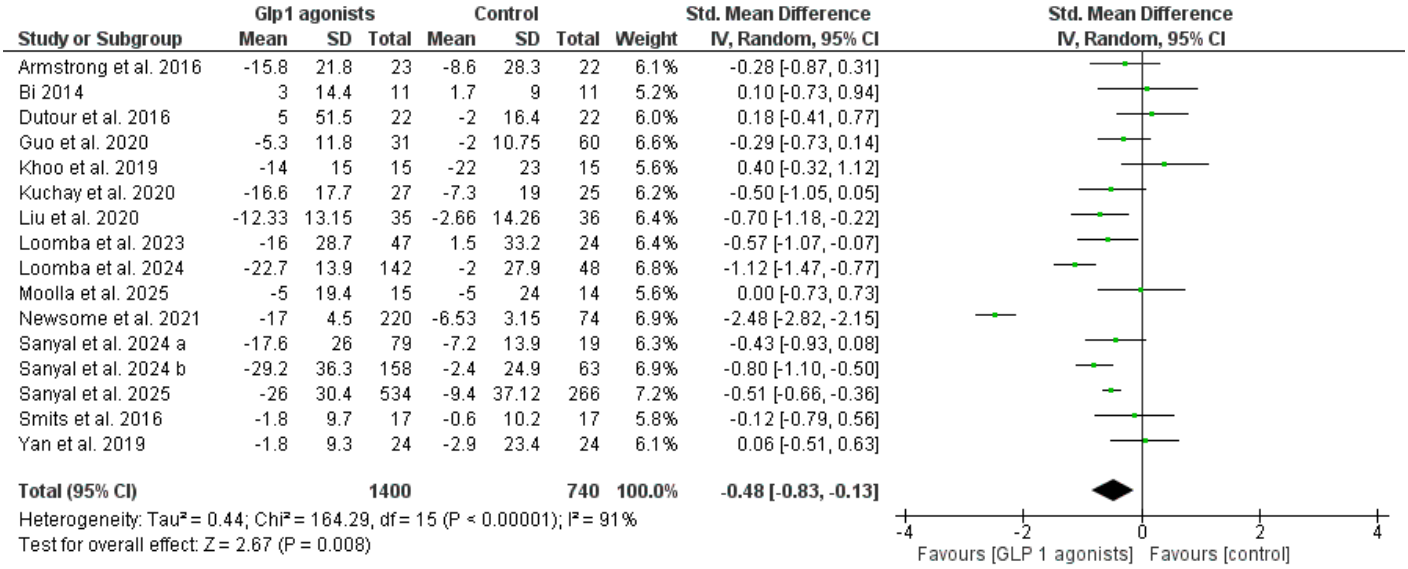
Supplementary Figure S24. Forest plot of change in HbA1c based on the intervention group (single, or dual or triple agonists) after leaving Harrison et al.



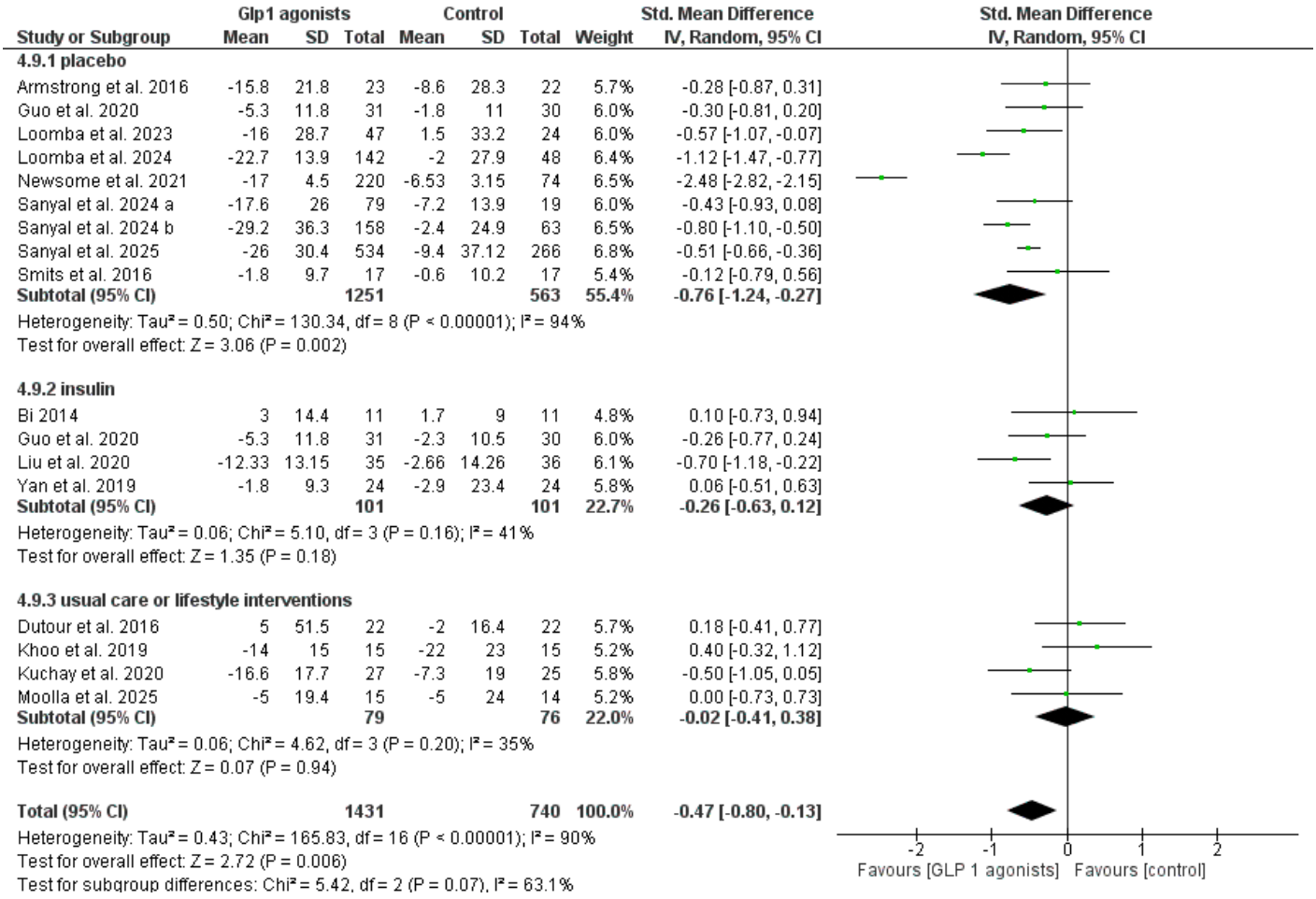
Supplementary Figure S25. Forest plot of change in CRP in the overall population .



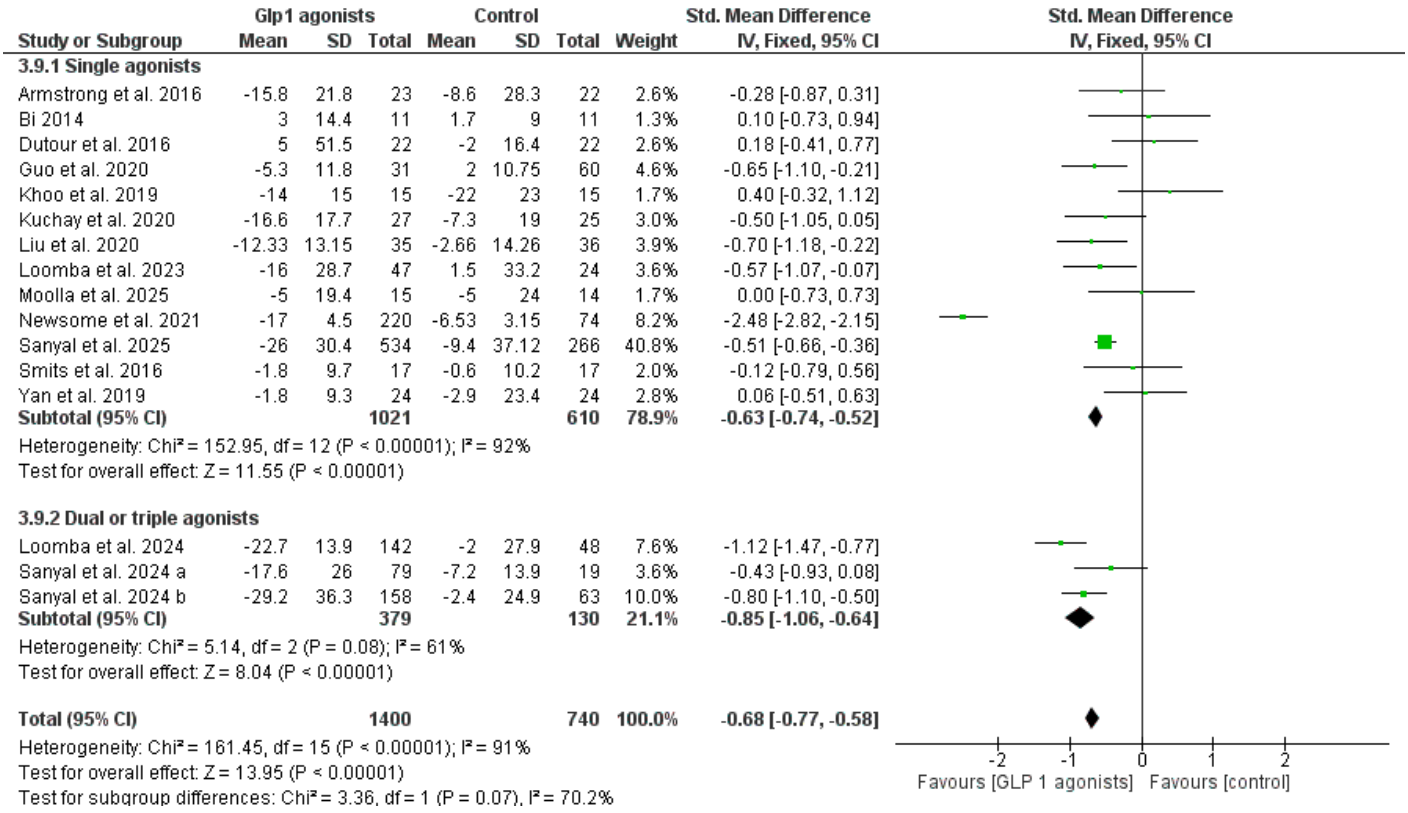
Supplementary Figure S26. Forest plot of the change in CRP in the overall population after leaving Harrison et al.



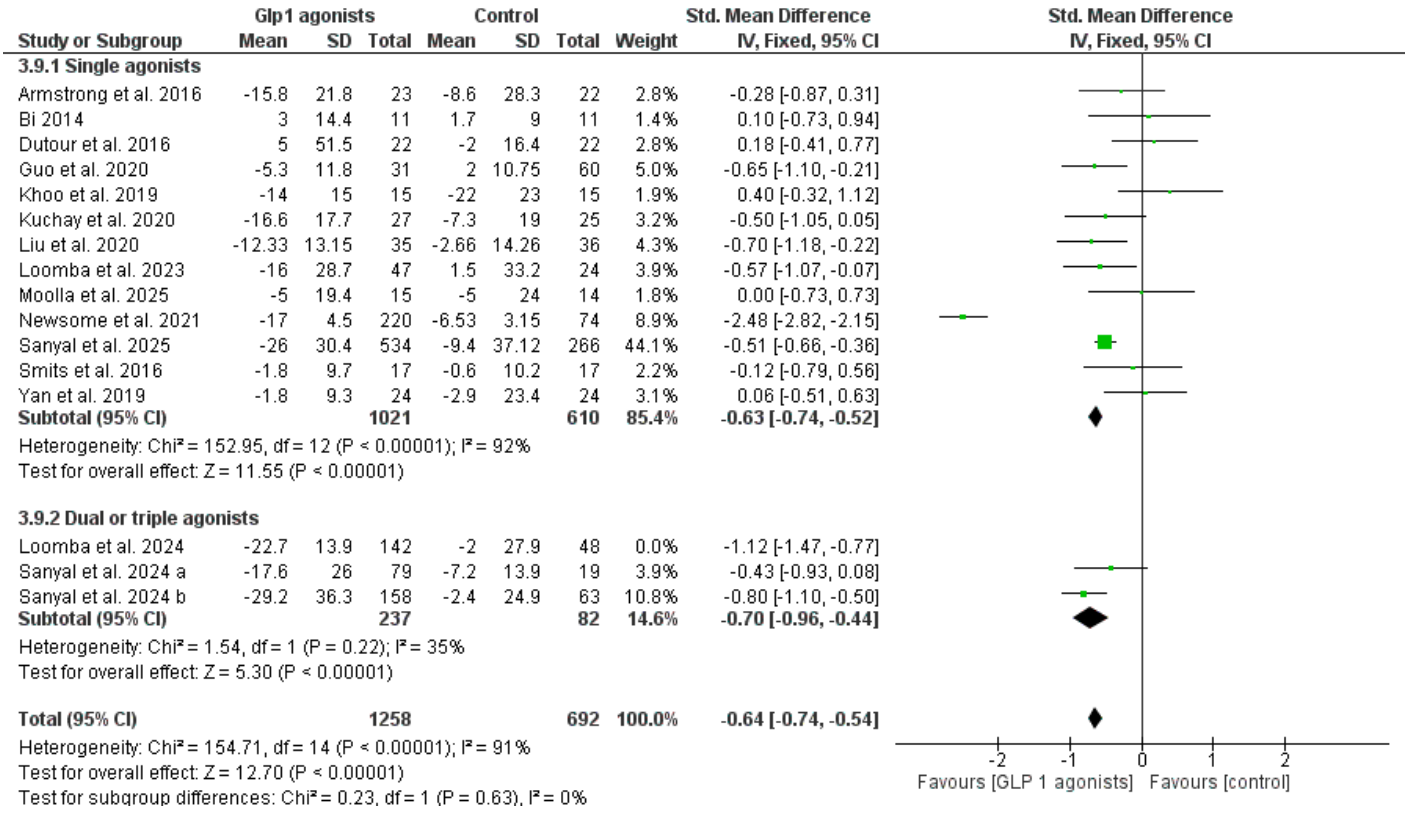
Supplementary Figure S27. Forest plot of the change in AST in the overall population.



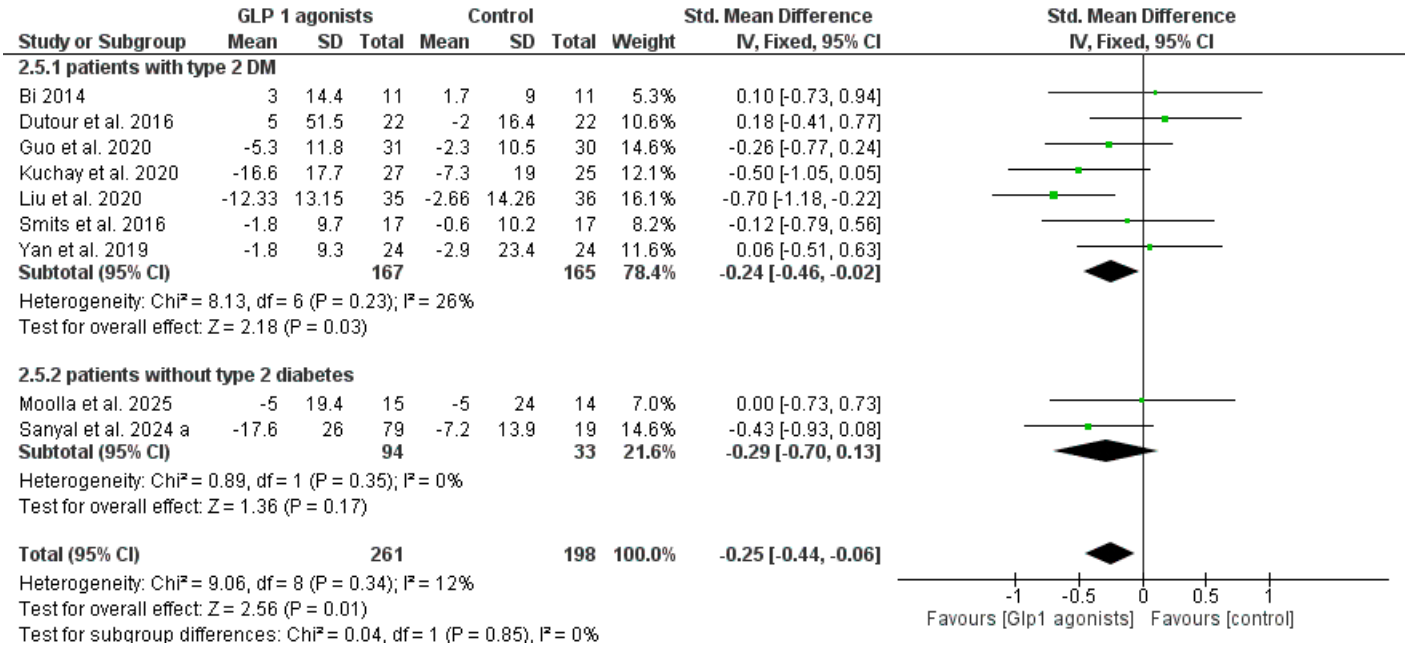
Supplementary Figure S28. Forest plot of the change in AST based on the control group.



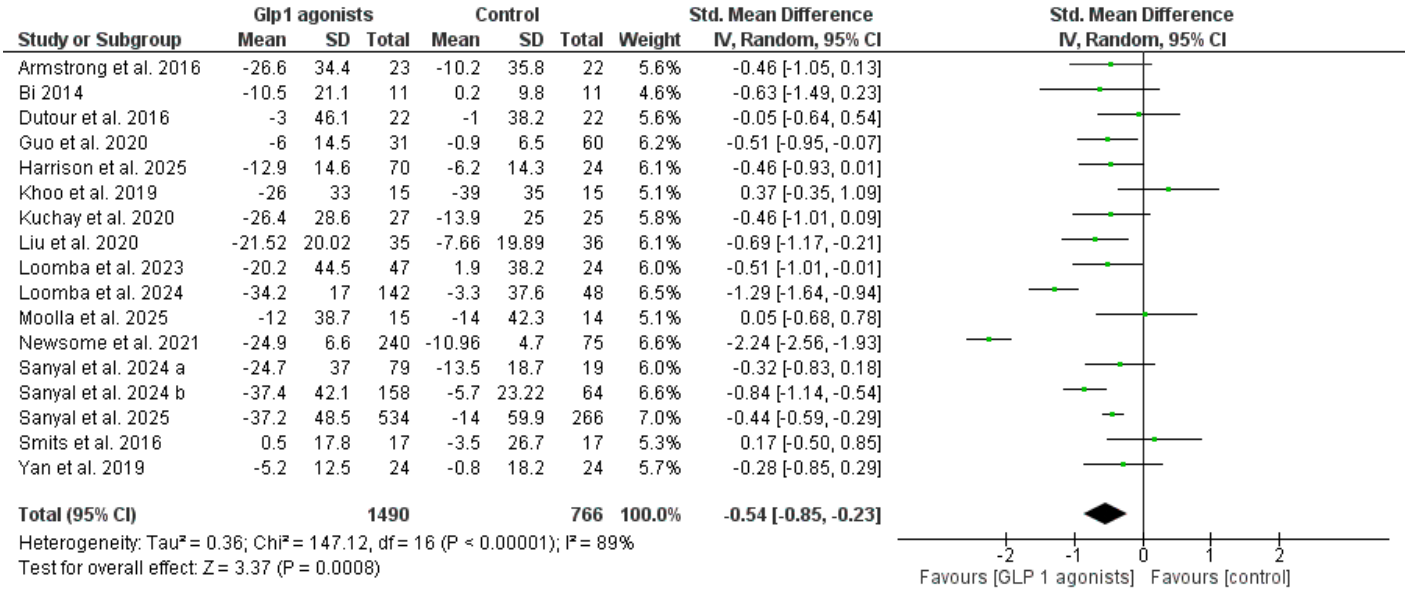
Supplementary Figure S29. Forest plot of the change in AST based on the intervention group (single, or dual or triple agonists).



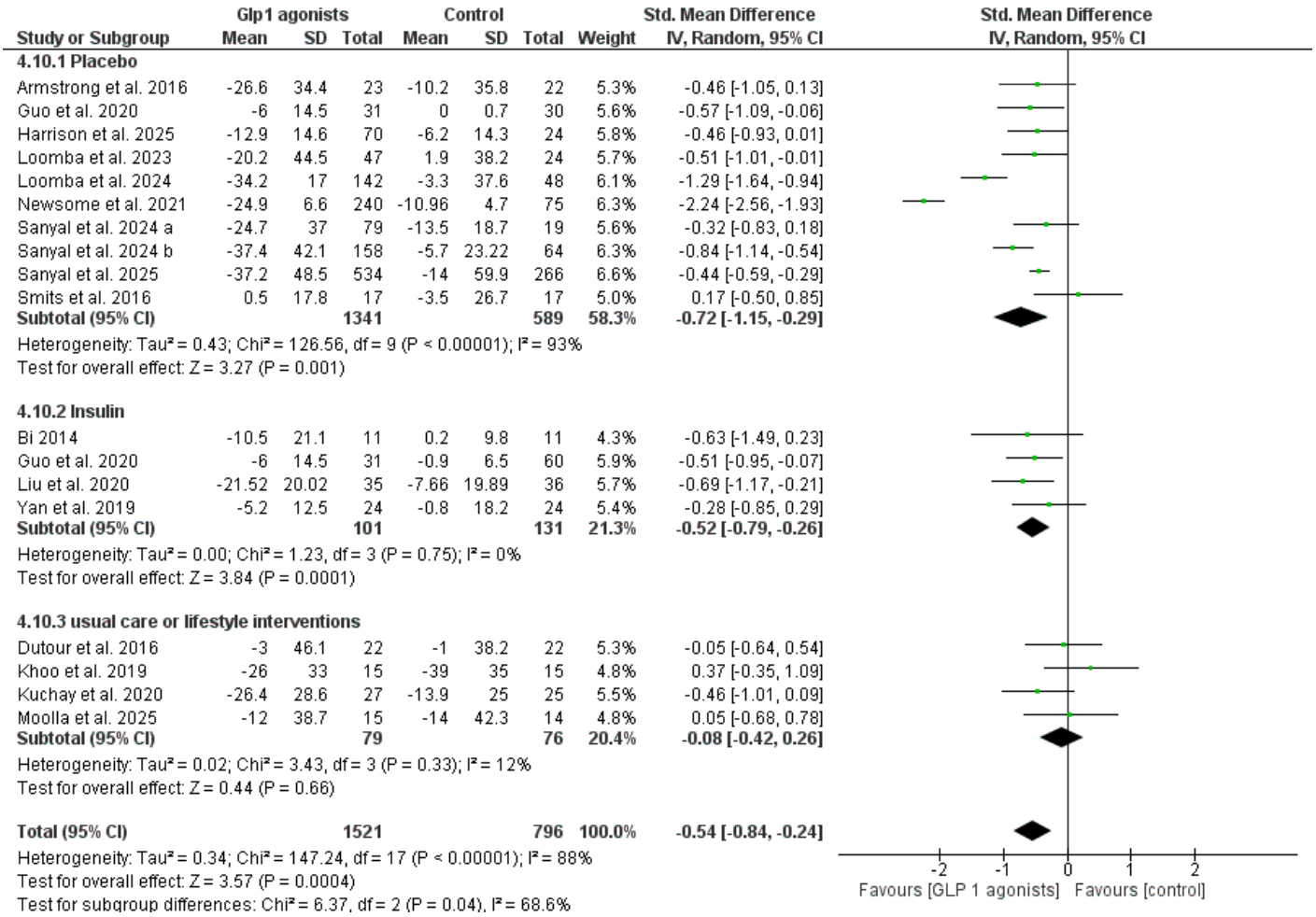
Supplementary Figure S30. Forest plot of the change in AST based on the intervention group (single, or dual or triple agonists) after leaving Loomba et al.



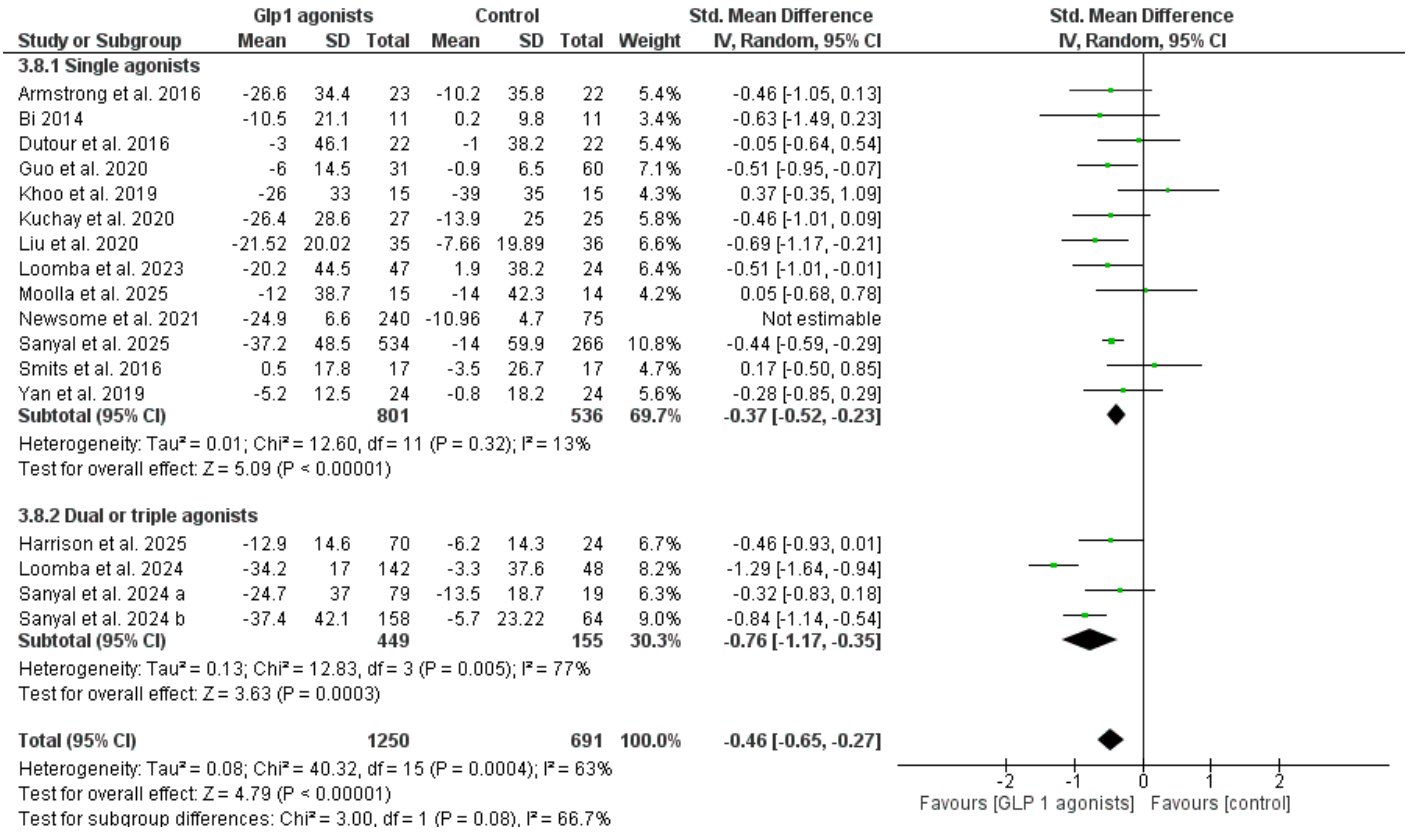
Supplementary Figure S31. Forest plot of the change in AST in patients with and without type 2 diabetes.



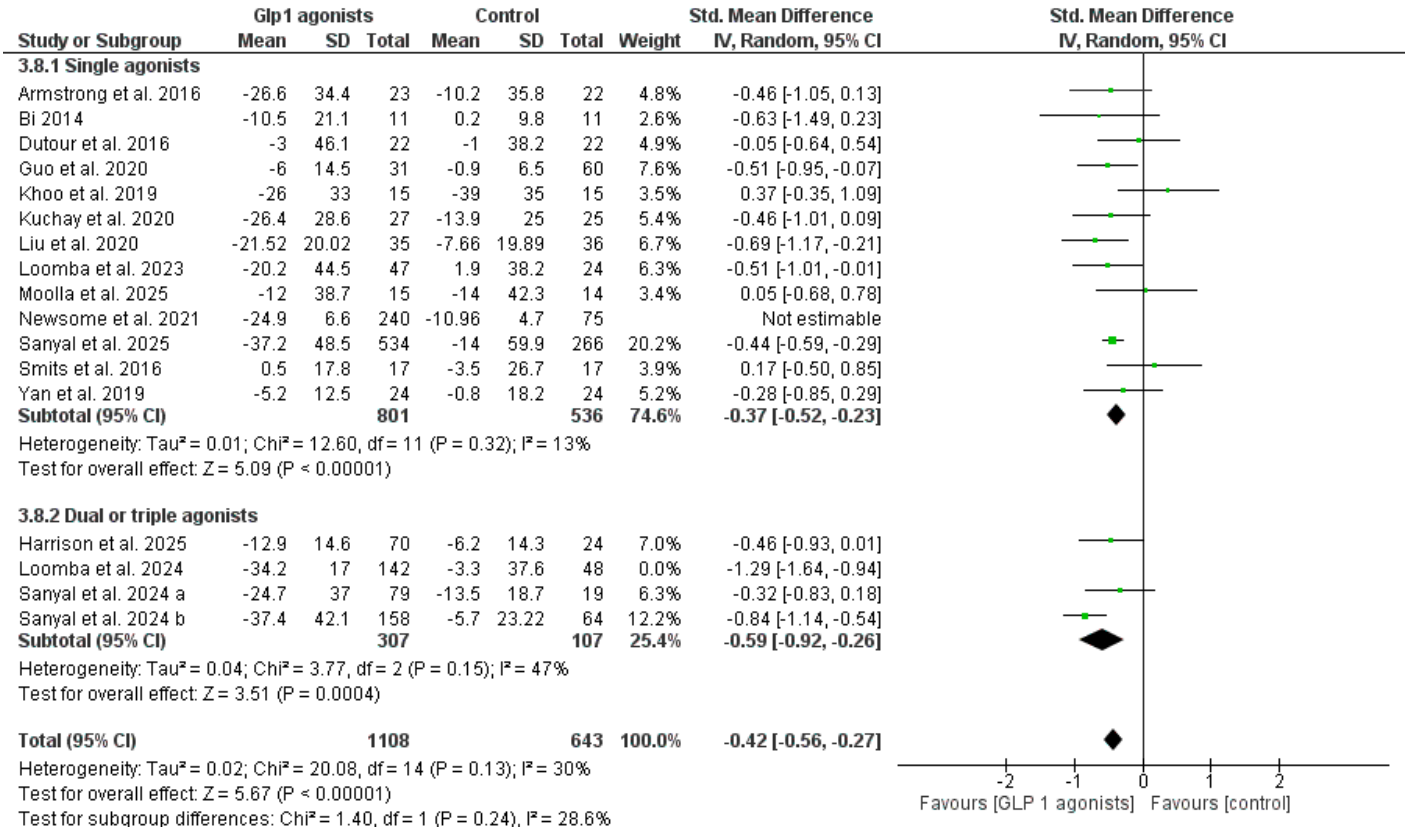
Supplementary Figure S32. Forest plot of the change in ALT in the overall population.



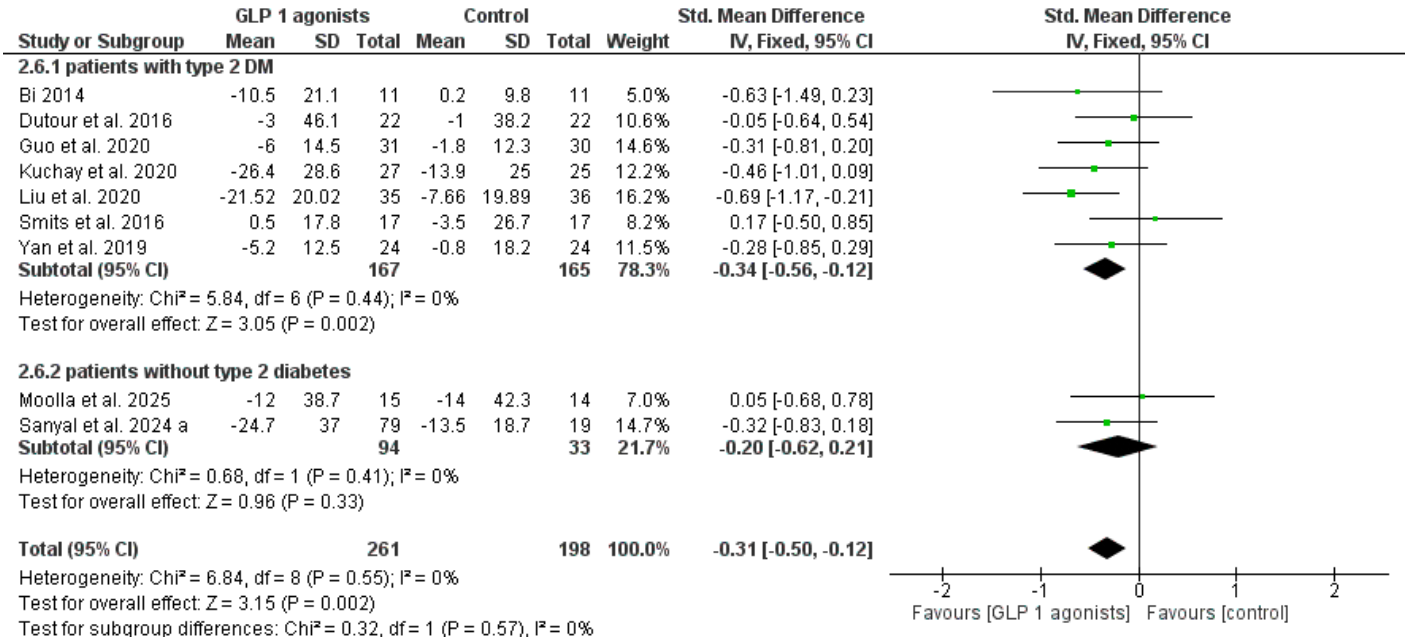
Supplementary Figure S33. Forest plot of the change in ALT based on the control group.



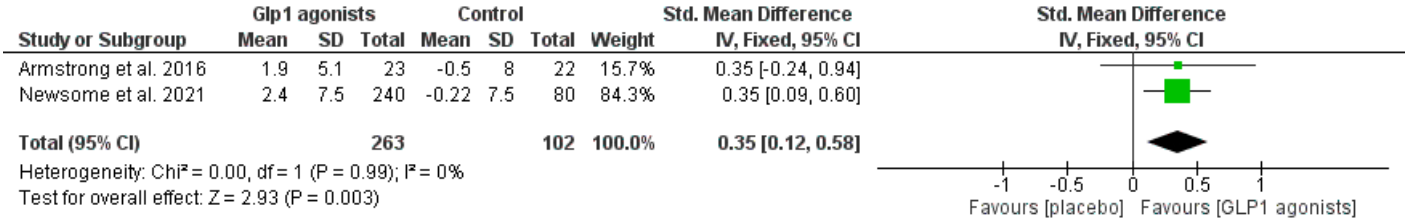
Supplementary Figure S34. Forest plot of the change in ALT based on the intervention group (single, or dual or triple agonists).



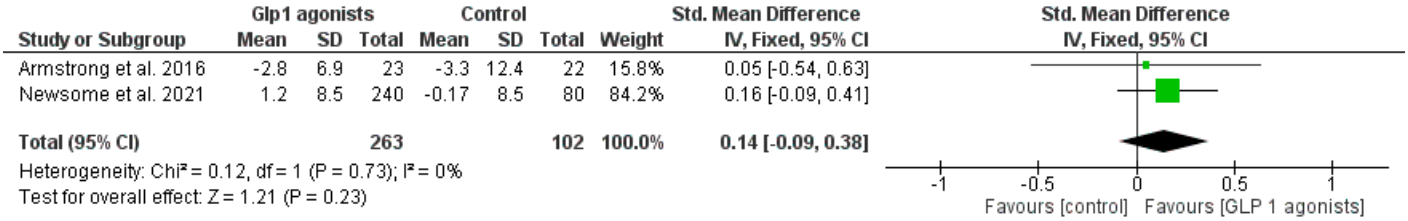
Supplementary Figure S35. Forest plot of the change in ALT based on the intervention group (single, or dual or triple agonists) after Leave-one-out test.



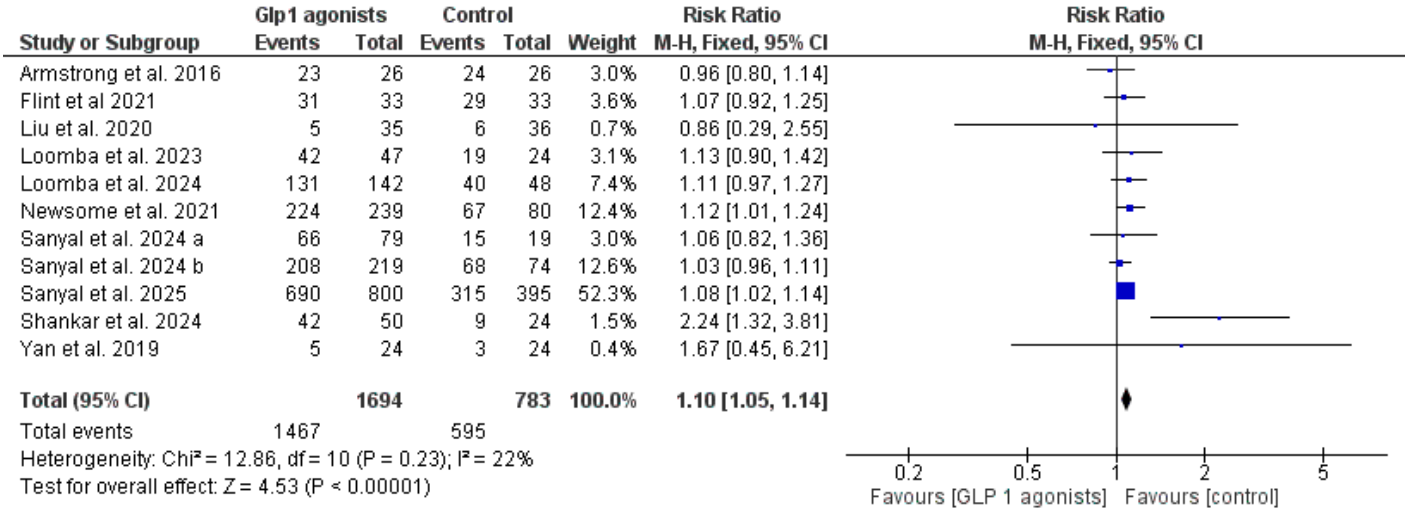
Supplementary Figure S36. Forest plot of the change in ALT in patients with and without type 2 diabetes.



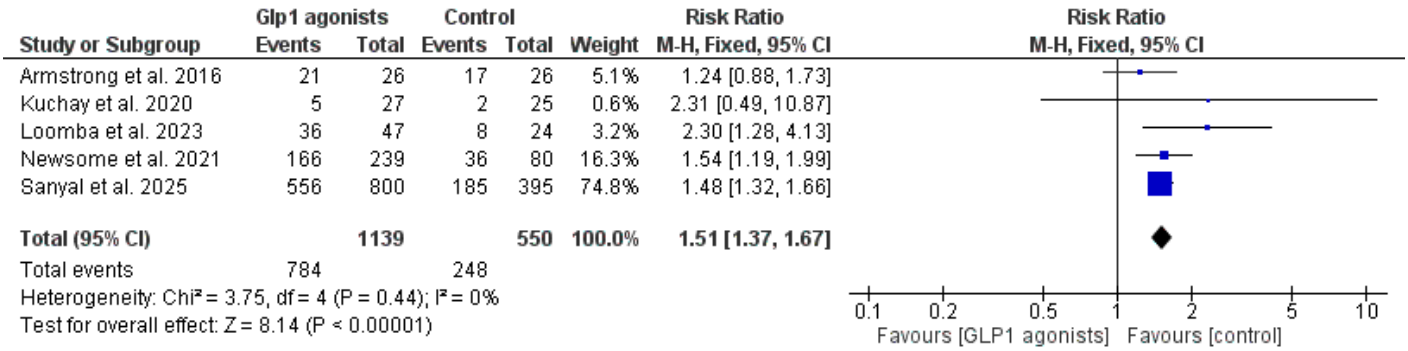
Supplementary Figure S37. Forest plot of the change Quality of life SF-36 (physical component).



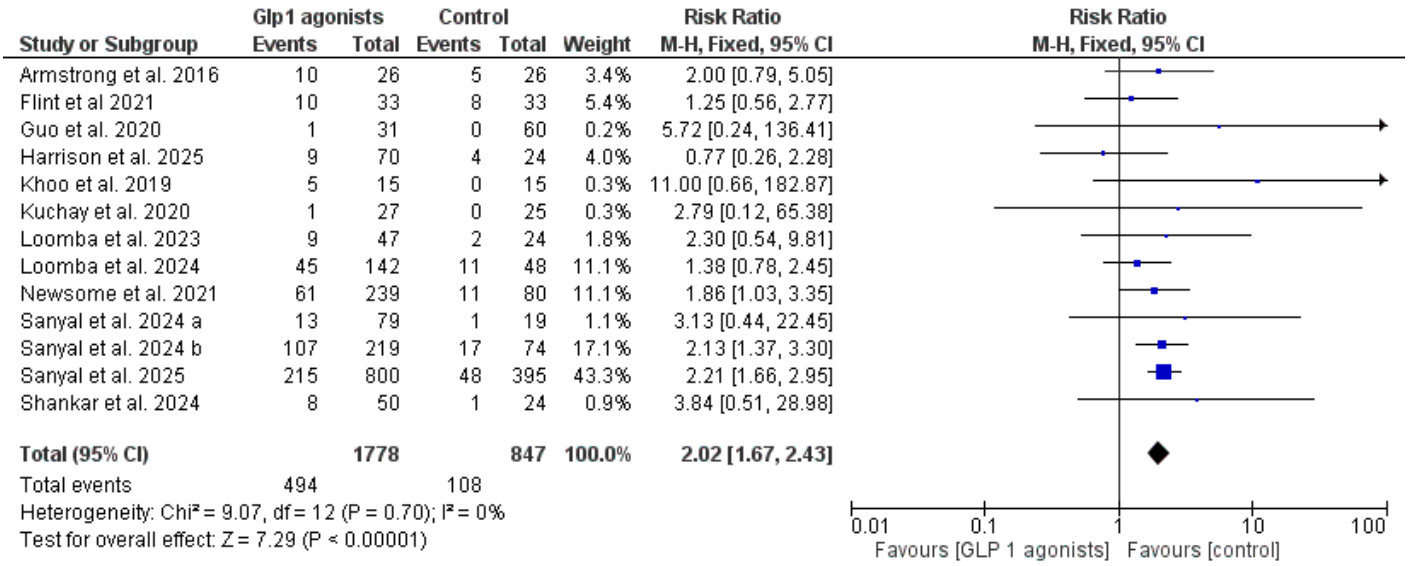
Supplementary Figure S38. Forest plot of the change Quality of life SF-36 (Mental component).



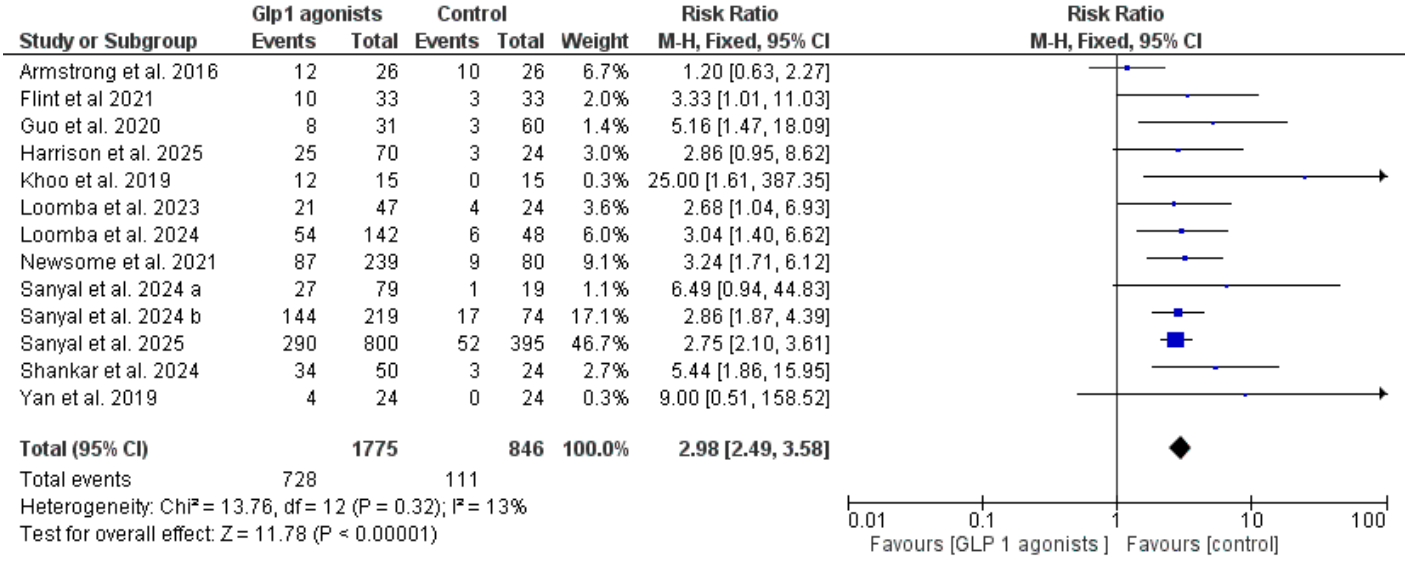
Supplementary Figure S39. Forest plot of the adverse events.



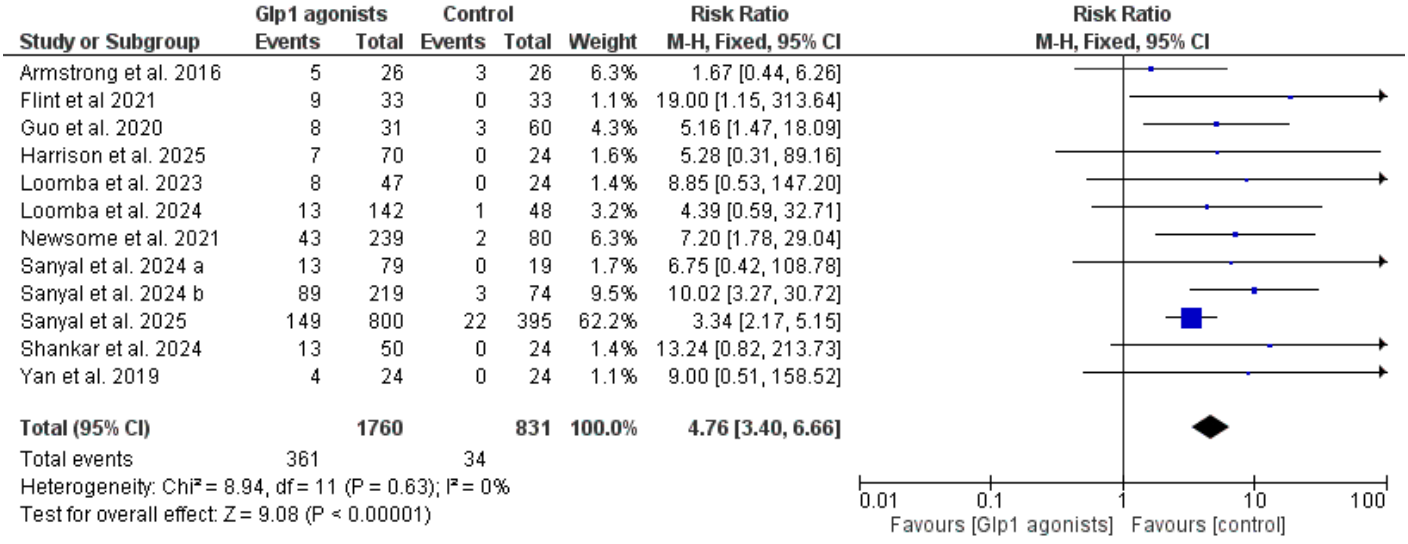
Supplementary Figure S40. Forest plot of the gastrointestinal adverse events.



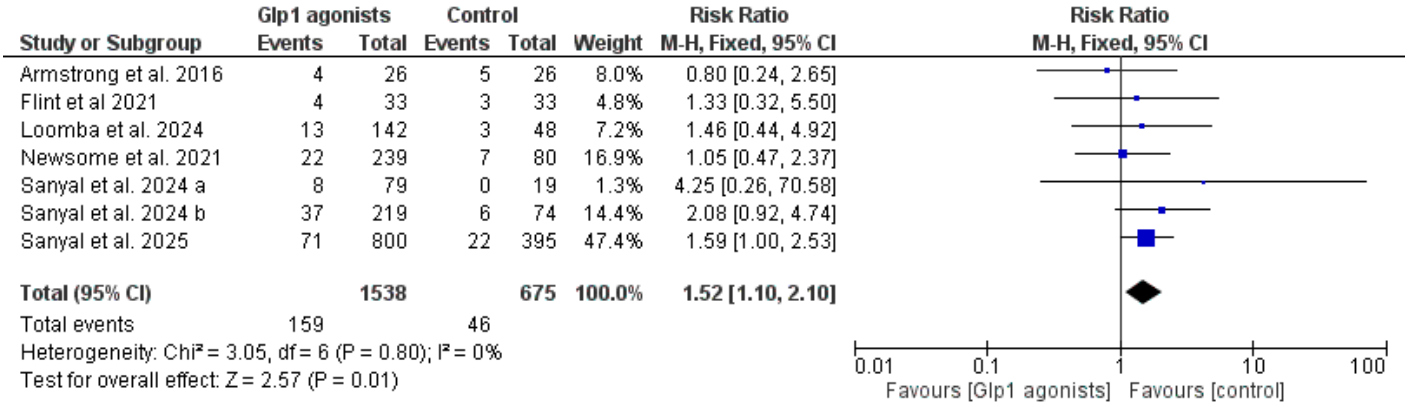
Supplementary Figure S41. Forest plot of diarrhea.



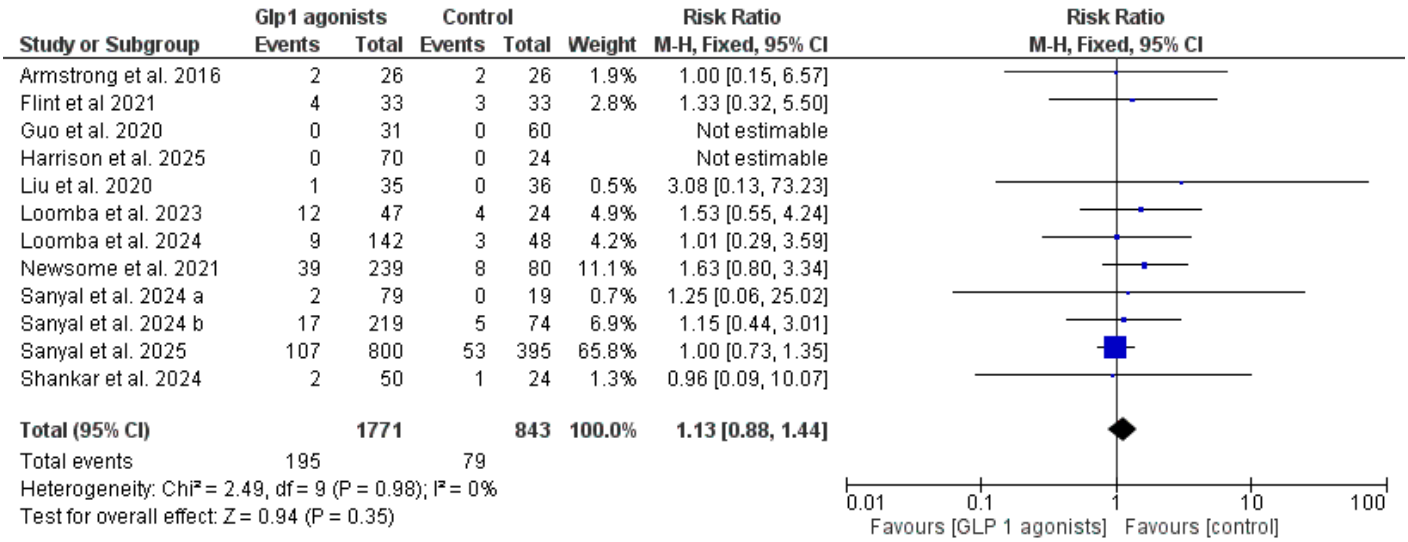
Supplementary Figure S42. Forest plot of nausea.



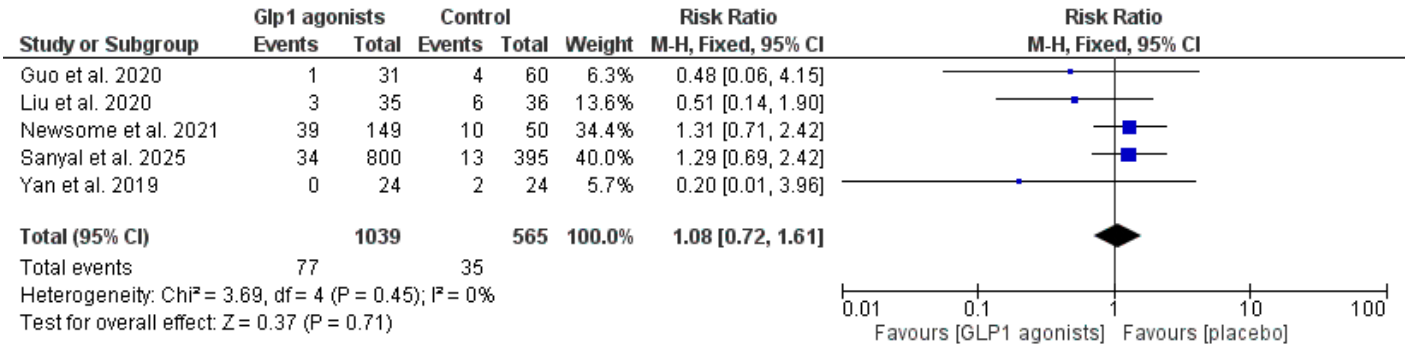
Supplementary Figure S43. Forest plot of vomiting.



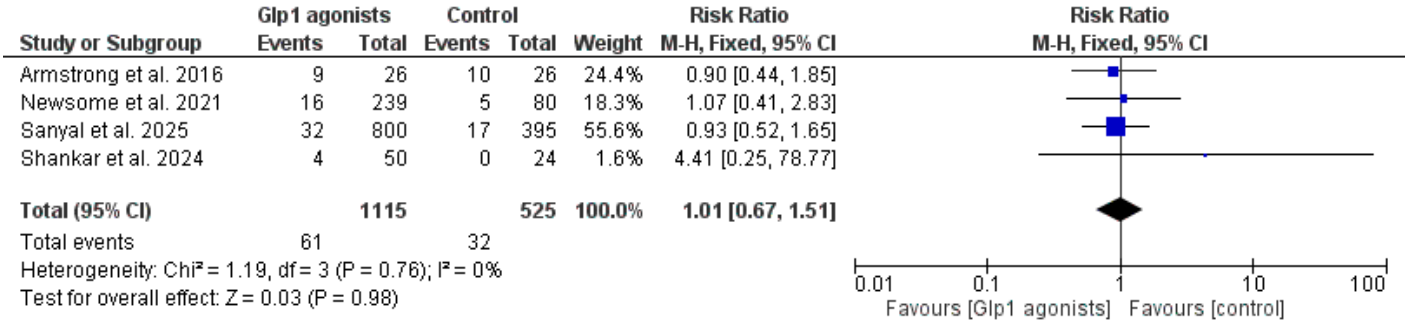
Supplementary Figure S44. Forest plot of fatigue.



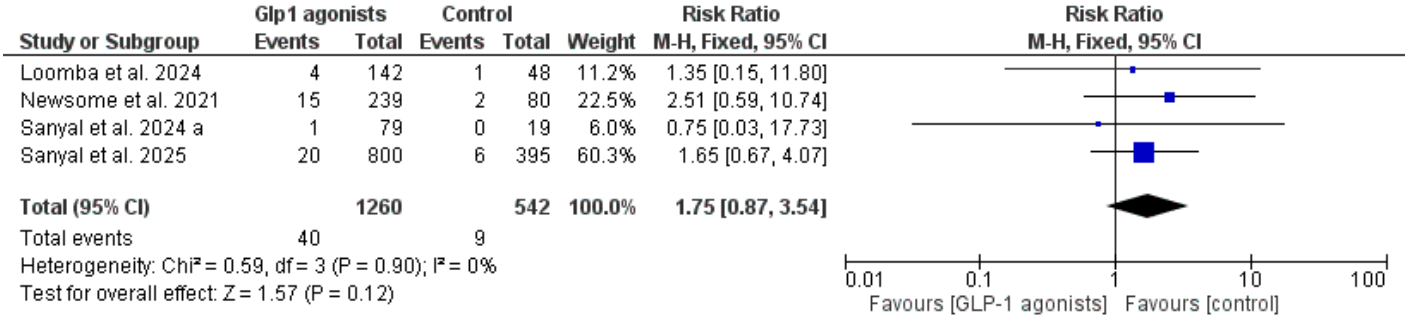
Supplementary Figure S45. Forest plot of serious adverse events.



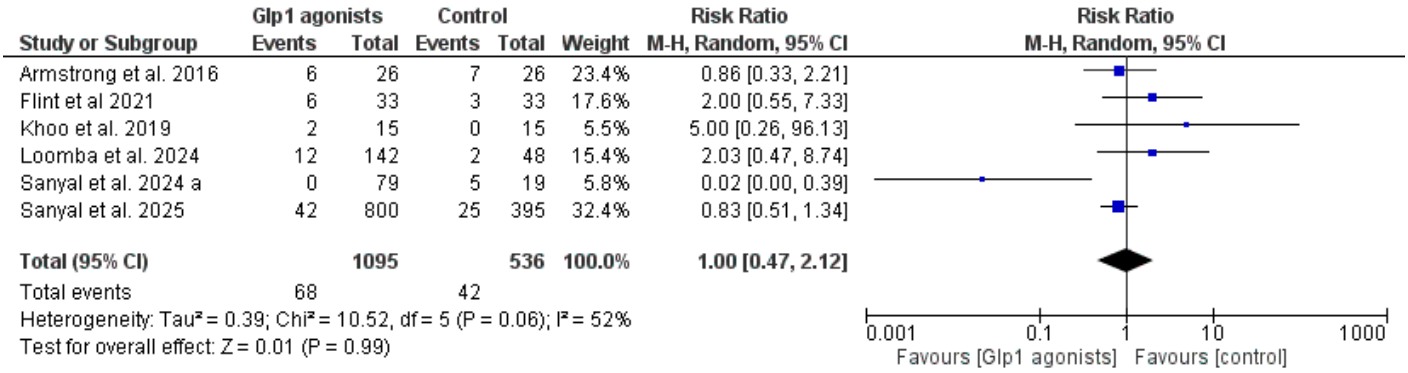
Supplementary Figure S46. Forest plot of hypoglycemia.



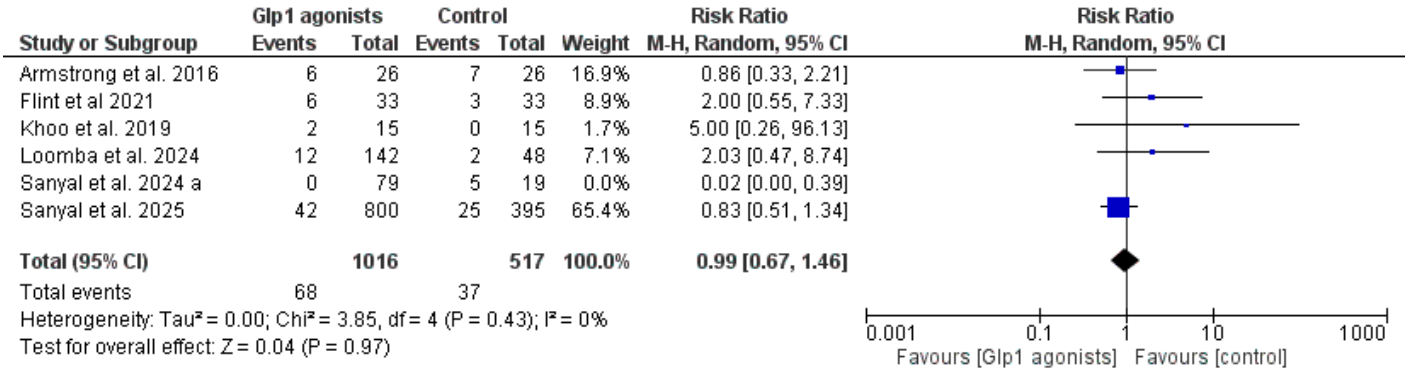
Supplementary Figure S47. Forest plot of injection site reactions.



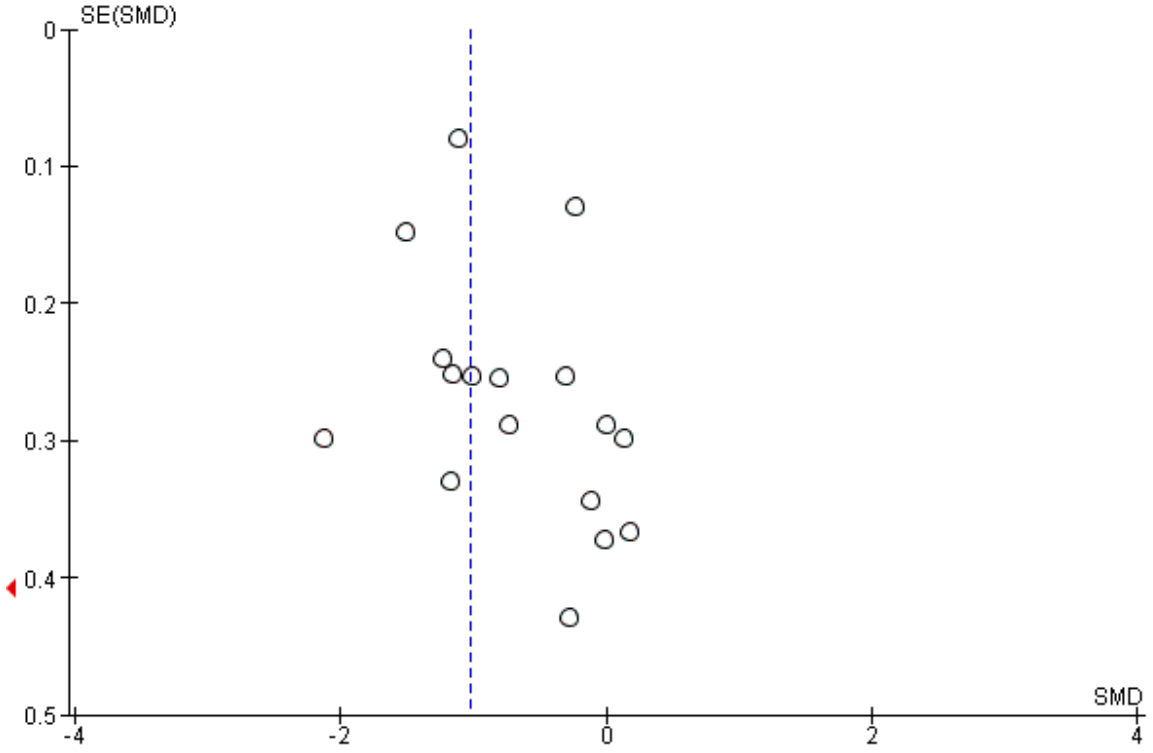
Supplementary Figure S48. Forest plot of gallbladder events.



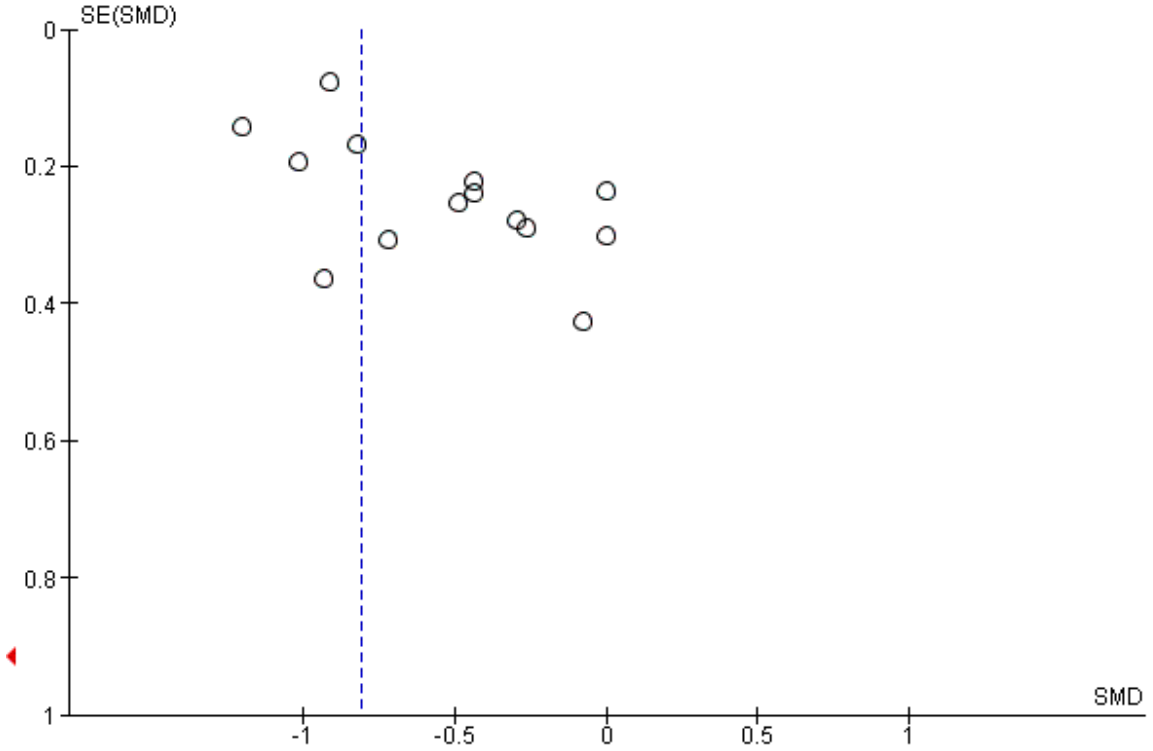
Supplementary Figure S49. Forest plot of dizziness.



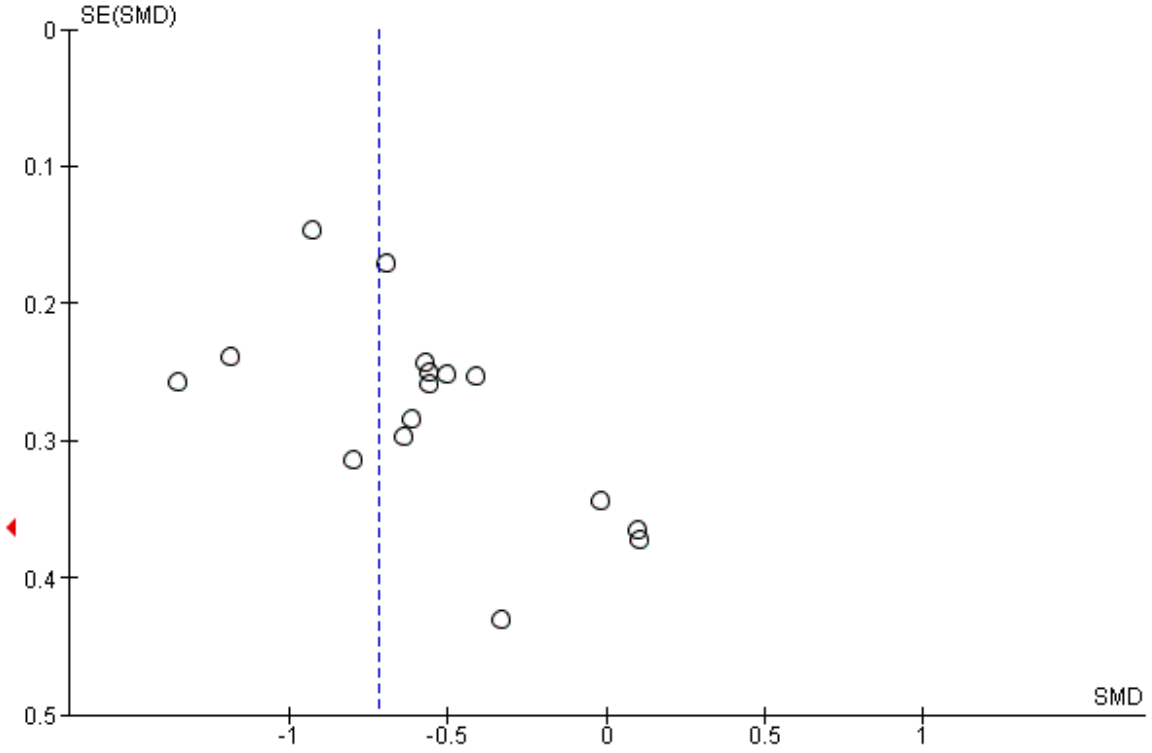
Supplementary Figure S50. Forest plot of dizziness after leaving Sanyal 2024 a.



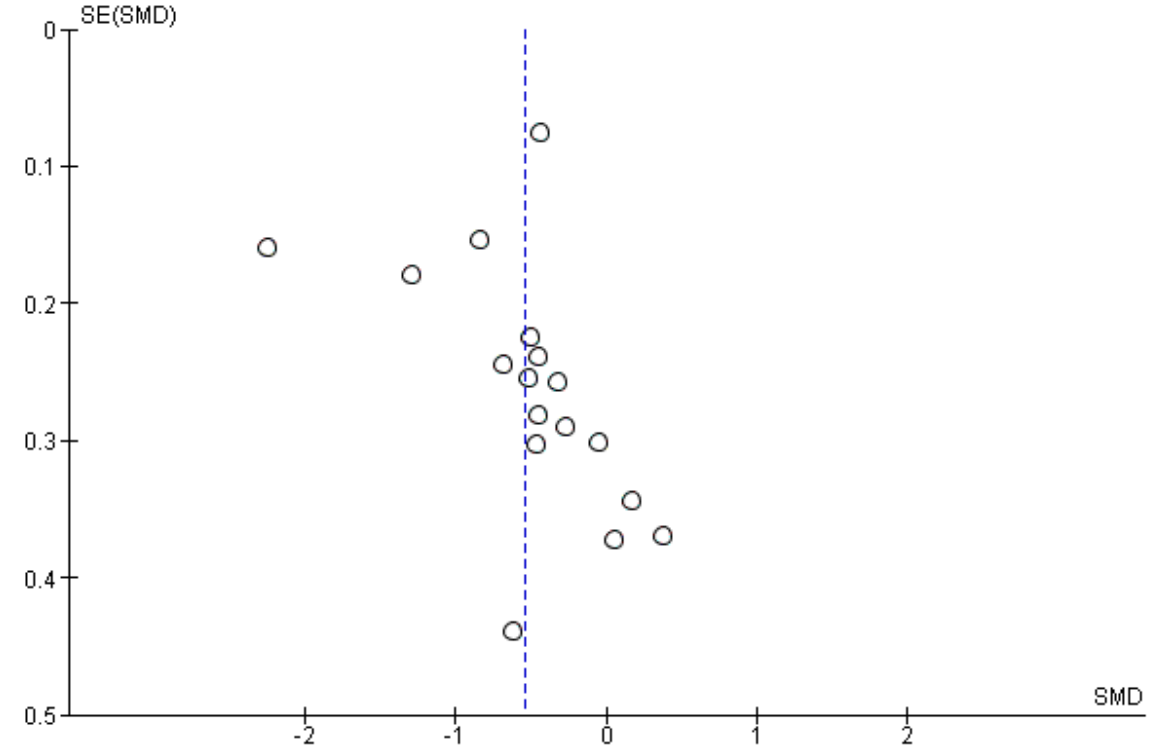
Supplementary Figure S51. Funnel plot of weight



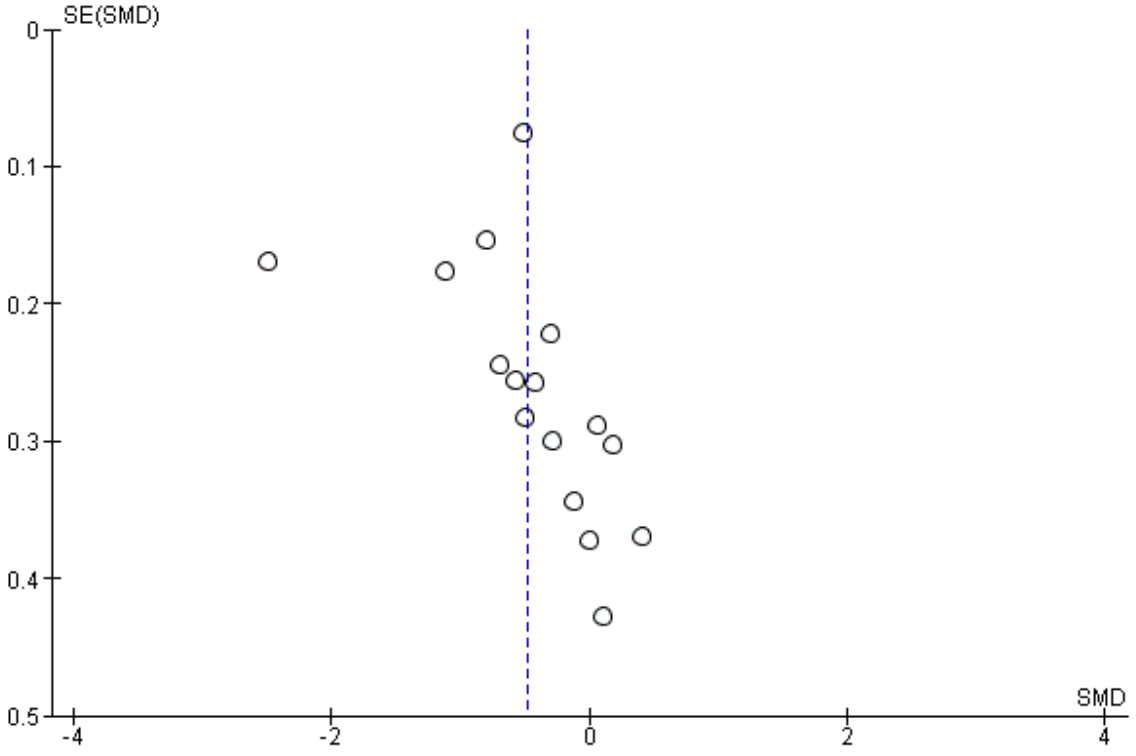
Supplementary Figure S52. Funnel plot of HbA1c



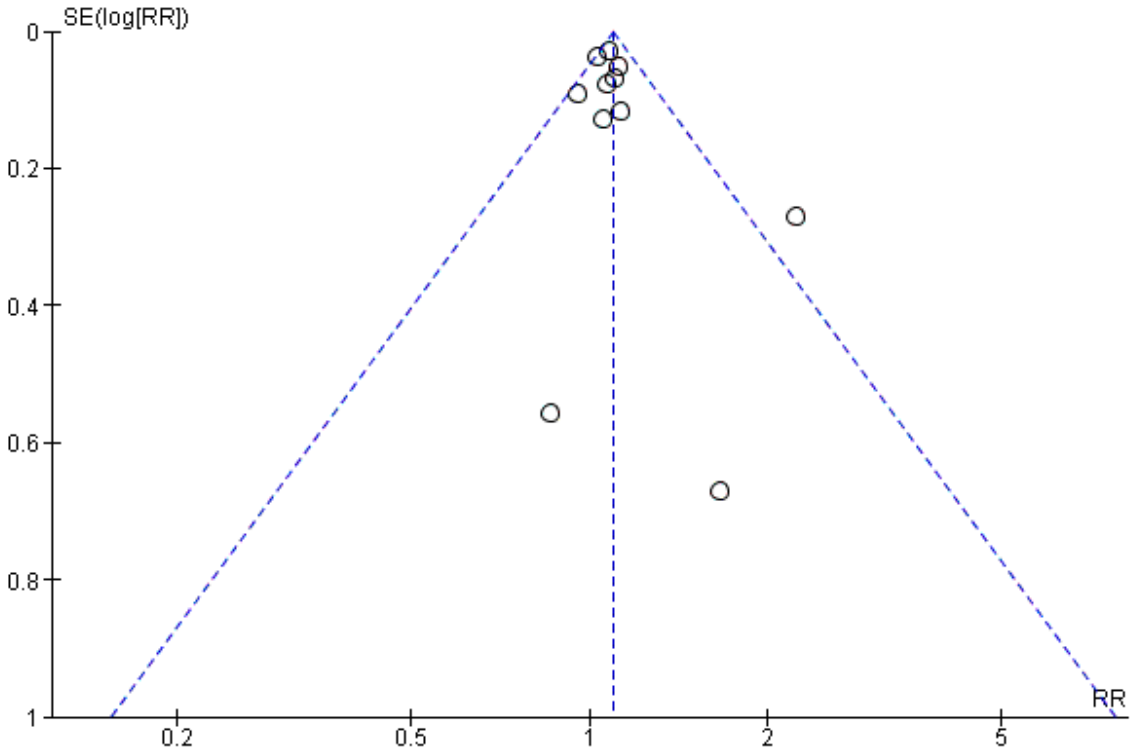
Supplementary Figure S53. Funnel plot of liver fat



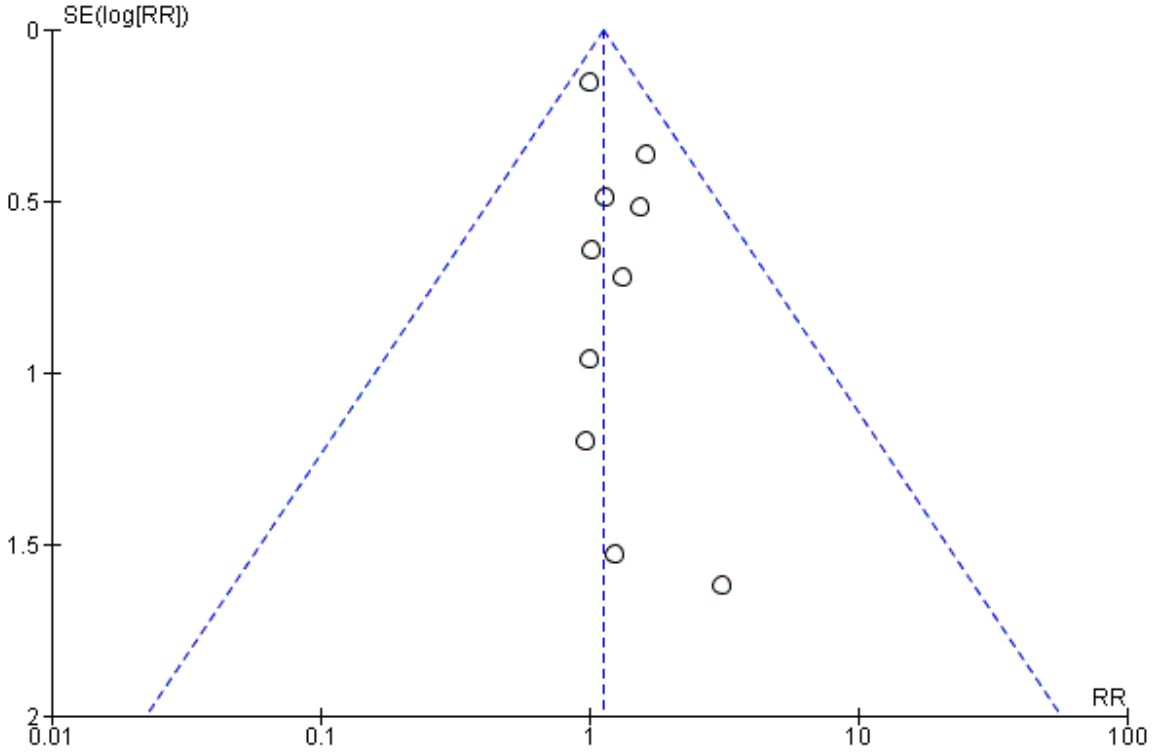
Supplementary Figure S54. Funnel plot of ALT



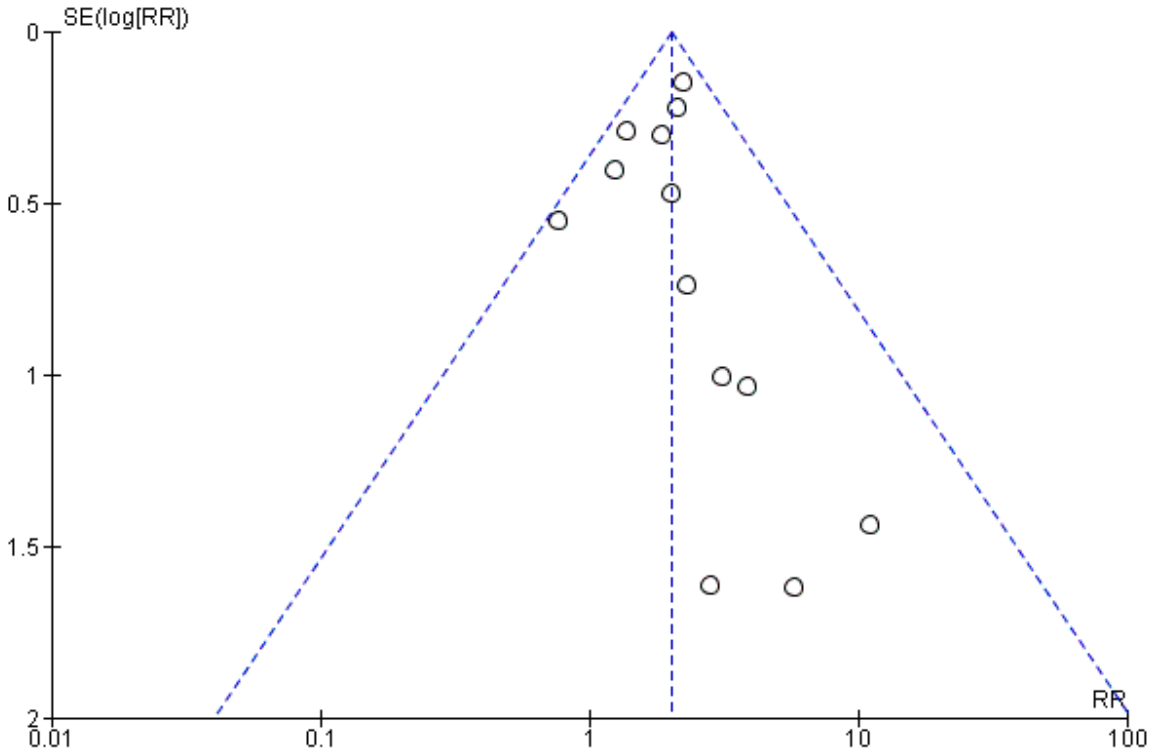
Supplementary Figure S55. Funnel plot of AST



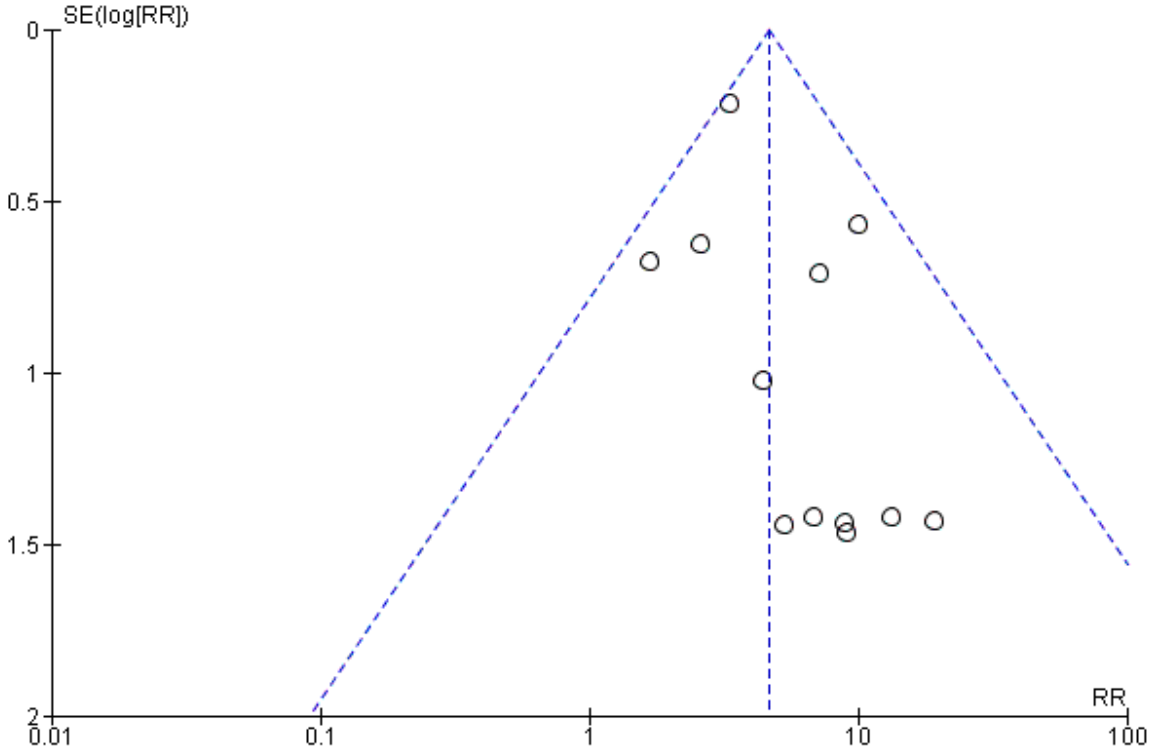
Supplementary Figure S56. Funnel plot of Adverse events.



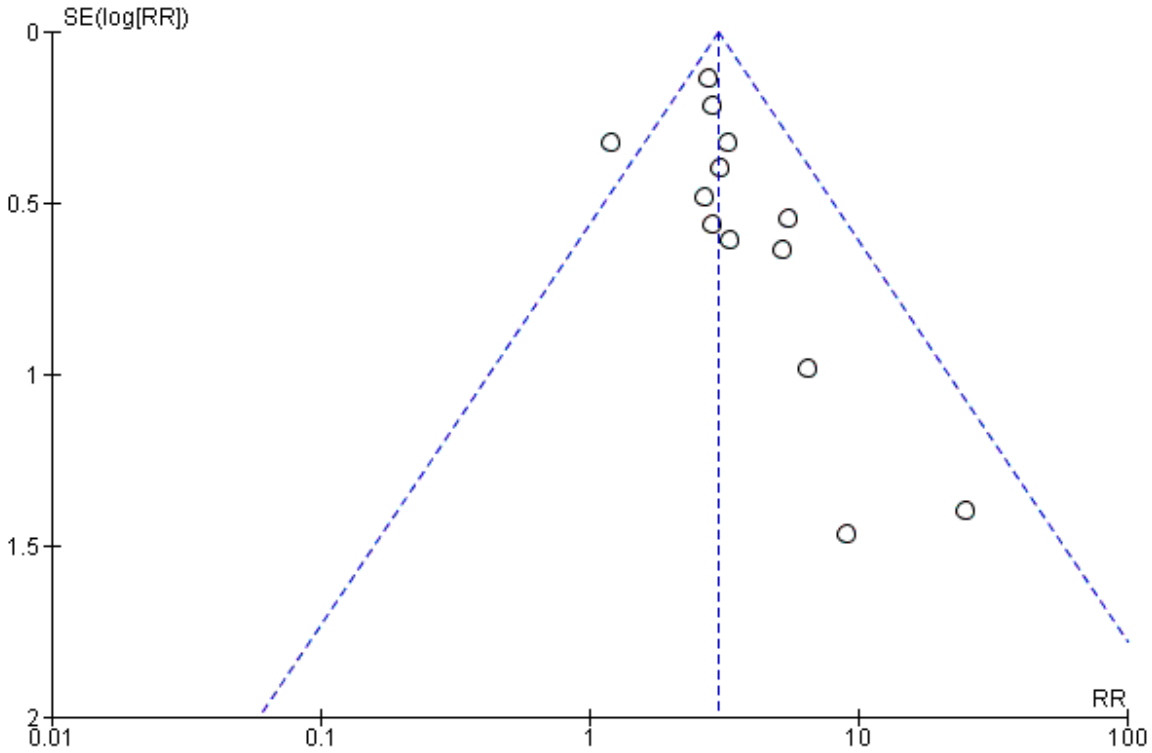
Supplementary Figure S57. Funnel plot of serious adverse events.



Supplementary Figure S58. Funnel plot of Diarrhea.



Supplementary Figure S59. Funnel plot of Vomiting.



Supplementary Figure S60. Funnel plot of nausea.