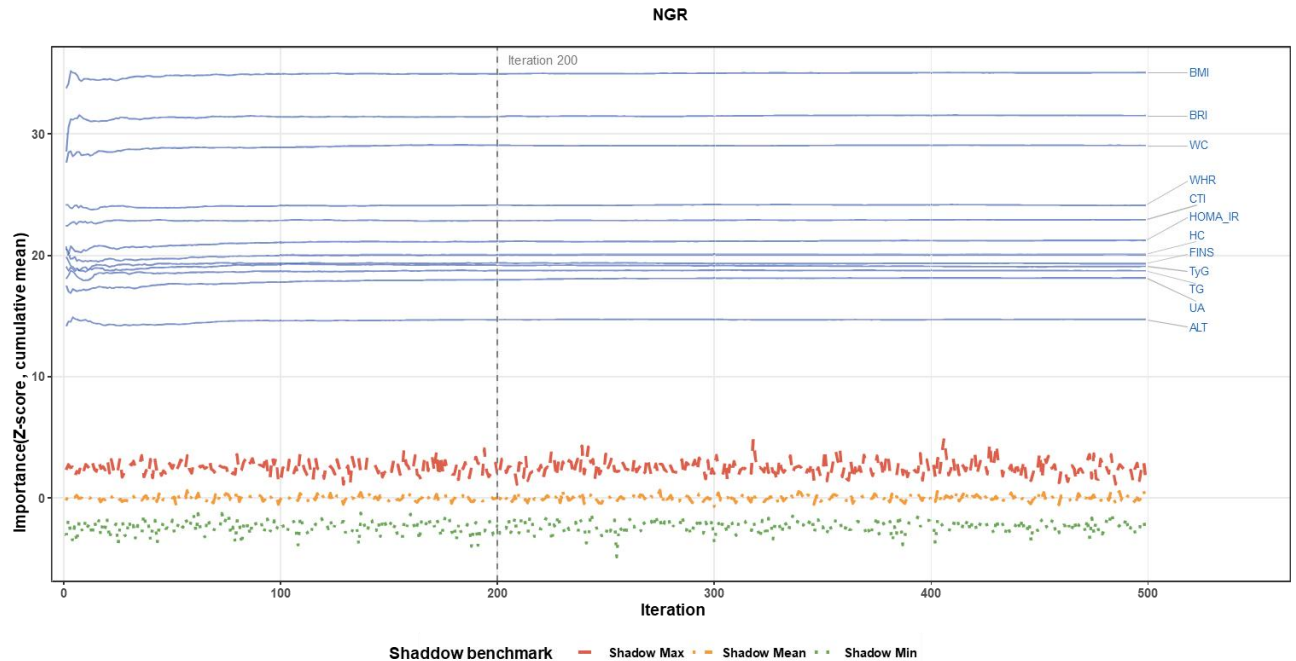
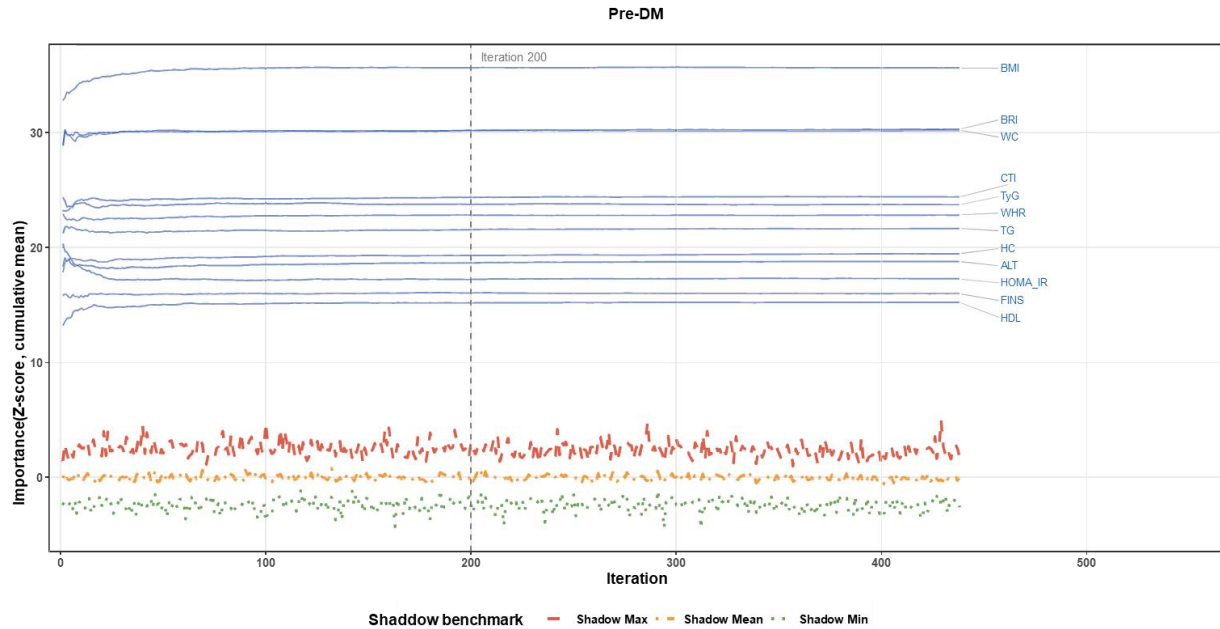


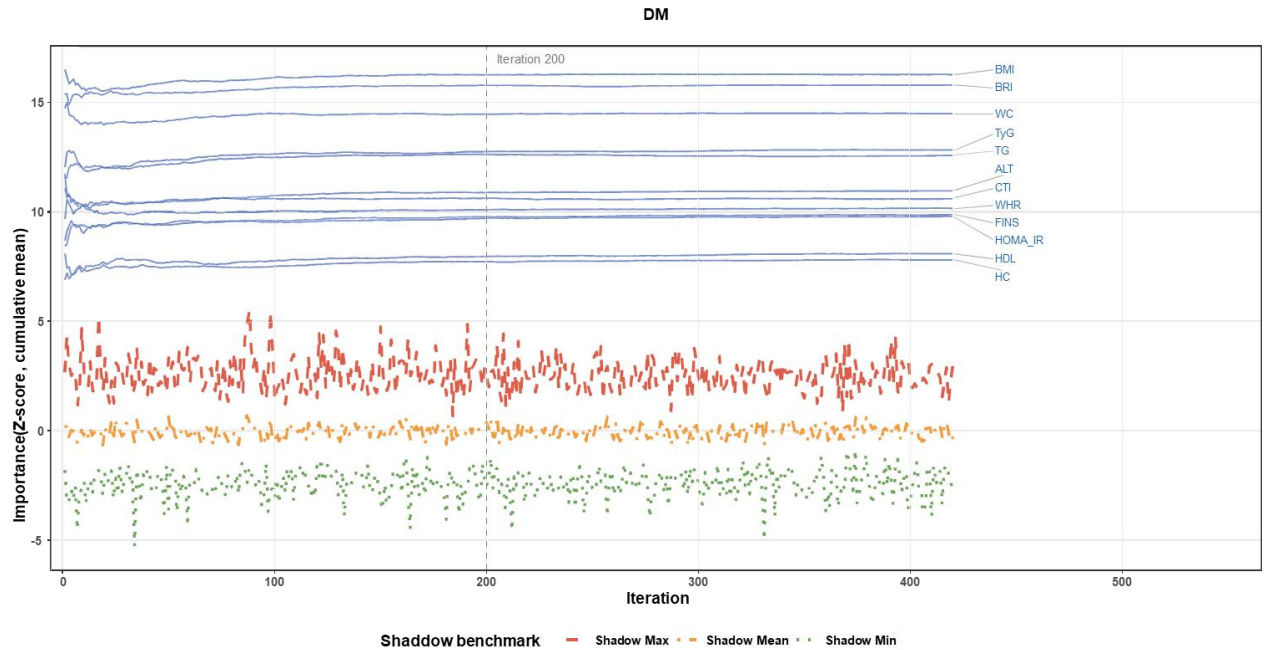
**Supplementary Figure 1 Boruta algorithm convergence diagnostics for feature importance analysis in the total population.** Convergence analysis was performed over 500 iterations of the Boruta algorithm. The figure shows the cumulative mean Z-score (importance) of the top 12 confirmed features compared with shadow benchmark features. Stable convergence curves achieved prior to iteration 200 indicate reliable feature ranking and sufficient algorithm convergence in the total cohort. BMI: Body mass index; BRI: Body roundness index; WC: Waist circumference; CTI: C-reactive protein-triglyceride-glucose index; WHR: Waist to hip ratio; TyG: Triglyceride-glucose index; TG: Triglycerides; HOMA-IR: Homeostatic model assessment of insulin resistance; FINS: Fasting insulin; ALT: Alanine aminotransferase; HC: Hip circumference; HDL: High-density lipoprotein.



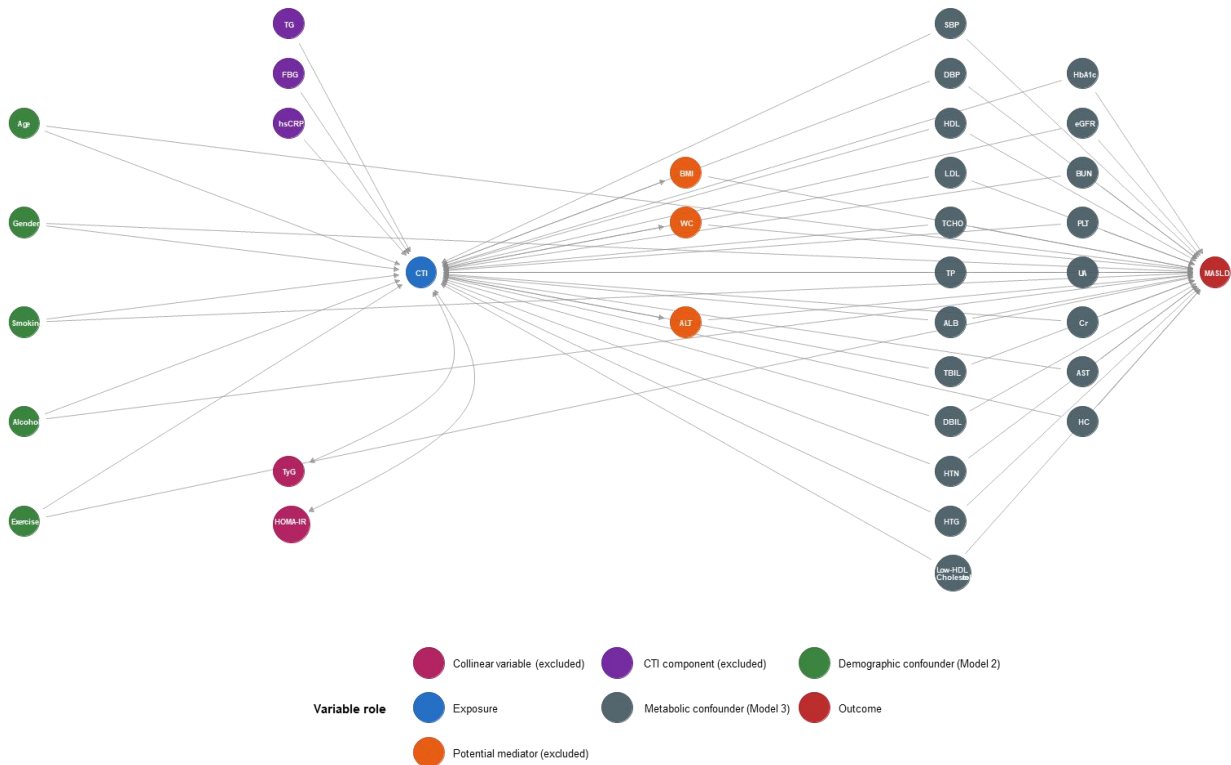
**Supplementary Figure 2 Boruta algorithm convergence diagnostics for feature importance analysis in the normal glucose regulation population.** Convergence analysis was conducted with 500 iterations of the Boruta algorithm. The figure presents the cumulative mean Z-score (importance) of the top 12 confirmed features, in comparison with shadow benchmarks including shadow max, shadow mean, and shadow min. Stable curves achieved before iteration 200 demonstrate sufficient convergence and reliable feature ranking in the normal glucose regulation subgroup. NGR: Normal glucose regulation; BMI: Body mass index; BRI: Body roundness index; WC: Waist circumference; CTI: C-reactive protein-triglyceride-glucose index; WHR: Waist to hip ratio; TyG: Triglyceride-glucose index; TG: Triglycerides; HOMA-IR: Homeostatic model assessment of insulin resistance; FINS: Fasting insulin; ALT: Alanine aminotransferase; HC: Hip circumference; UA: Uric acid.



**Supplementary Figure 3 Boruta algorithm convergence diagnostics for feature importance analysis in the prediabetes mellitus population.** Convergence analysis was conducted with 500 iterations of the Boruta algorithm. The figure presents the cumulative mean Z-score (importance) of the top 12 confirmed features, in comparison with shadow benchmarks including shadow max, shadow mean, and shadow min. Stable curves achieved before iteration 200 demonstrate sufficient convergence and reliable feature ranking in the prediabetes subgroup. Pre-DM: Prediabetes mellitus; BMI: Body mass index; BRI: Body roundness index; WC: Waist circumference; CTI: C-reactive protein-triglyceride-glucose index; WHR: Waist to hip ratio; TG: Triglycerides; HOMA-IR: Homeostatic model assessment of insulin resistance; FINS: Fasting insulin; ALT: Alanine aminotransferase; HC: Hip circumference; HDL: High-density lipoprotein.



**Supplementary Figure 4 Boruta algorithm convergence diagnostics for feature importance analysis in the diabetes mellitus population.** Convergence analysis was conducted with 500 iterations of the Boruta algorithm. The figure presents the cumulative mean Z-score (importance) of the top 12 confirmed features, in comparison with shadow benchmarks including shadow max, shadow mean, and shadow min. Stable curves achieved before iteration 200 demonstrate sufficient convergence and reliable feature ranking in the DM subgroup. DM: Diabetes mellitus; BMI: Body mass index; BRI: Body roundness index; WC: Waist circumference; TyG: Triglyceride-glucose index; CTI: C-reactive protein-triglyceride-glucose index; WHR: Waist to hip ratio; TG: Triglycerides; HOMA-IR: Homeostatic model assessment of insulin resistance; FINS: Fasting insulin; ALT: Alanine aminotransferase; HC: Hip circumference; HDL: High-density lipoprotein.



**Supplementary Figure 5 Directed acyclic graph for covariate selection in the study.** A directed acyclic graph was used to identify and select confounding variables according to causal inference framework, guiding the final covariate adjustment set for statistical modeling. NGR: Normal glucose regulation; Pre-DM: Prediabetes mellitus; DM: Diabetes mellitus; BMI: Body mass index; BRI: Body roundness index; WC: Waist circumference; CTI: C-reactive protein-triglyceride-glucose index; WHR: Waist to hip ratio; TyG: Triglyceride-glucose index; TG: Triglycerides; HOMA-IR: Homeostatic model assessment of insulin resistance; FINS: Fasting insulin; ALT: Alanine aminotransferase; HC: Hip circumference; HDL: High-density lipoprotein; UA: Uric acid; HbA1c: Glycated haemoglobin; HTG: Hypertriglyceridemia; FPG: Fasting plasma glucose; hs-CRP: High-sensitivity C-reactive protein; DBP: Diastolic blood pressure; SBP: Systolic blood pressure; AST: Aspartate aminotransferase; FIB-4: Fibrosis-4 index; Cr: Serum creatinine; APRI: Aspartate aminotransferase to platelet ratio index; NFS: Non-alcoholic fatty liver disease fibrosis score; ALB: Albumin; TP: Total protein; TCHO: Total cholesterol; PLT:

Platelet count; eGFR: Estimated glomerular filtration rate; DBIL: Direct bilirubin;  
LDL: Low-density lipoprotein; TBIL: Total bilirubin; BUN: Blood urea nitrogen;  
HTN: Hypertension.

**Supplementary Table 1 Receiver operating characteristic curve analysis of biomarkers and risk scores for metabolic dysfunction-associated steatotic liver disease prediction in men patients, stratified by glycemic status**

	AUC	95%CI	Cut value	off	Sensitivity	Specificity	<i>P</i> for difference in AUC
NGR (N = 1,395)							
CTI	0.728	0.701 0.755	to 8.595		0.773	0.58	Ref.
TyG	0.708	0.680 0.735	to 8.774		0.609	0.719	<0.001
hsCRP	0.550	0.519 0.581	to 1.273		0.747	0.35	<0.001
FIB-4	0.508	0.477 0.539	to -3.279		0.779	0.253	<0.001
NFS	0.549	0.518 0.579	to 0.254		0.627	0.455	<0.001
APRI	0.629	0.600 0.659	to 1.205		0.61	0.598	<0.001
ALT	0.68	0.652 0.709	to 22.5		0.665	0.612	<0.001

AST	0.591	0.561	to	22.5	0.609	0.526	<0.001
		0.621					
Anthropometric indices*	0.838	0.817	to	/	0.765	0.766	<0.001
		0.859					
Anthropometric indices*+CTI	0.843	0.822	to	/	0.759	0.78	<0.001
		0.863					
Conventional risk factors <sup>#</sup>	0.772	0.747	to	/	0.736	0.677	<0.001
		0.796					
Conventional risk factors <sup>#</sup> +CTI	0.774	0.749	to	/	0.738	0.68	<0.001
		0.799					
Pre-DM (N = 2,104)							
CTI	0.772	0.749	to	8.936	0.738	0.676	Ref.
		0.794					
TyG	0.759	0.736	to	8.809	0.723	0.664	<0.001
		0.782					
hsCRP	0.612	0.585	to	1.3	0.682	0.488	<0.001
		0.639					
FIB-4	0.56	0.532	to	-1.655	0.788	0.31	<0.001
		0.588					

NFS	0.556	0.529	to	0.321	0.39	0.704	<0.001
		0.583					
APRI	0.646	0.619	to	1.395	0.628	0.627	<0.001
		0.673					
ALT	0.726	0.702	to	0.75	0.581	0.757	<0.001
		26.5					
AST	0.612	0.586	to	24.5	0.521	0.651	<0.001
		0.639					
Anthropometric indices*	0.843	0.824	to	/	0.715	0.801	<0.001
		0.861					
Anthropometric indices*+CTI	0.849	0.831	to	/	0.686	0.84	<0.001
		0.867					
Conventional risk factors#	0.773	0.75	to	0.795	/	0.648	0.755
							<0.001
Conventional risk factors#+CTI	0.777	0.754	to	/	0.779	0.629	<0.001
		0.799					
DM (N = 658)							
CTI	0.778	0.732	to	9.619	0.622	0.8	Ref.
		0.823					
TyG	0.783	0.737	to	9.070	0.797	0.635	<0.001
		0.830					

hsCRP	0.644	0.588 0.701	to	1.292	0.586	0.661	<0.001
FIB-4	0.645	0.589 0.702	to	-0.578	0.68	0.565	<0.001
NFS	0.561	0.505 0.617	to	0.272	0.593	0.539	<0.001
APRI	0.630	0.576 0.685	to	1.205	0.681	0.522	<0.001
ALT	0.748	0.701 0.794	to	24.50	0.646	0.757	<0.001
AST	0.650	0.599 0.702	to	26.50	0.383	0.887	<0.001
Anthropometric indices*	0.785	0.74 to 0.830	/		0.707	0.73	<0.001
Anthropometric indices*+CTI	0.796	0.752 0.840	to	/	0.733	0.722	<0.001
Conventional risk factors <sup>#</sup>	0.760	0.714 0.806	to	/	0.744	0.652	<0.001
Conventional risk factors <sup>#</sup> +CTI	0.764	0.718 0.810	to	/	0.753	0.643	<0.001

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\*Anthropometric indices: BMI, WC, HC, WHR, BRI

#Conventional risk factors: Age, Sex, Current smoking, Current drinking, Regular exercise, BMI, WC, HC, WHR, BRI, AST, ALT, TCHO, TG, HDL-C, FPG, SBP.

Abbreviations: receiver operating characteristic curve (ROC); area under the curve (AUC); confidence interval (CI); high-sensitivity C-reactive protein-triglyceride-glucose index (CTI); metabolic dysfunction-associated steatotic liver disease (MASLD); high-sensitivity C-reactive protein (hs-CRP); triglyceride-glucose index (TyG); Fibrosis-4 index (FIB-4); NAFLD fibrosis score (NFS); AST to platelet ratio index (APRI); alanine aminotransferase (ALT); aspartate aminotransferase (AST); body-mass index (BMI); waist circumference (WC); hip circumference (HC); Waist to hip ratio (WHR); Body roundness index (BRI); total cholesterol (TCHO); triglycerides (TG); high-density lipoprotein cholesterol (HDL-C); fasting plasma glucose (FPG); systolic blood pressure (SBP); Normal glucose regulation (NGR); Prediabetes mellitus (Pre-DM); Diabetes mellitus (DM).

**Supplementary Table 2 Receiver operating characteristic curve analysis of biomarkers and risk scores for metabolic dysfunction-associated steatotic liver disease prediction in women patients, stratified by glycemic status**

	AUC	95%CI	Cut value	off	Sensitivity	Specificity	P for difference in AUC
NGR (N = 1,538)							
CTI	0.777	0.747 0.806	to 8.432		0.730	0.698	Ref.

TyG	0.783	0.754 0.811	to	8.484	0.690	0.762	<0.001
hsCRP	0.503	0.467 0.539	to	0.947	0.567	0.47	<0.001
FIB-4	0.516	0.478 0.554	to	-2.349	0.463	0.599	<0.001
NFS	0.505	0.468 0.541	to	0.249	0.427	0.609	<0.001
APRI	0.648	0.614 0.682	to	0.965	0.703	0.543	<0.001
ALT	0.668	0.634 0.702	to	16.50	0.587	0.665	<0.001
AST	0.580	0.544 0.617	to	22.50	0.410	0.714	<0.001
Anthropometric indices*	0.830	0.806 0.855	to	/	0.810	0.695	<0.001
Anthropometric indices*+CTI	0.838	0.814 0.861	to	/	0.747	0.768	<0.001
Conventional risk factors#	0.810	0.786	to	/	0.837	0.650	<0.001

Conventional factors#+CTI	risk	0.812	0.833	to /	0.837	0.654	<0.001
		0.789	0.835				
Pre-DM (N = 1,445)							
CTI		0.758	0.734	to 8.809	0.695	0.698	Ref.
			0.783				
TyG		0.743	0.718	to 8.705	0.67	0.715	<0.001
			0.769				
hsCRP		0.544	0.514	to 1.602	0.784	0.297	<0.001
			0.574				
FIB-4		0.500	0.470	to -2.186	0.497	0.526	<0.001
			0.530				
NFS		0.510	0.480	to 0.214	0.681	0.361	<0.001
			0.540				
APRI		0.654	0.626	to 1.035	0.758	0.499	<0.001
			0.682				
ALT		0.67	0.642	to 17.50	0.661	0.601	<0.001
			0.697				
AST		0.562	0.533	to 22.50	0.533	0.572	<0.001

Anthropometric indices*	0.792	0.769	to		0.702	0.74	<0.001
		0.815	/				
Anthropometric indices*+CTI	0.799	0.777	to		0.771	0.689	<0.001
		0.822	/				
Conventional risk factors <sup>#</sup>	0.744	0.719	to		0.778	0.611	<0.001
		0.769	/				
Conventional risk factors <sup>#</sup> +CTI	0.747	0.722	to		0.792	0.598	<0.001
		0.772	/				
DM (N = 273)							
CTI	0.674	0.606	to	9.31	0.637	0.639	Ref.
		0.742					
TyG	0.656	0.587	to	8.978	0.721	0.542	<0.001
		0.724					
hsCRP	0.582	0.508	to	1.566	0.716	0.458	<0.001
		0.655					
FIB-4	0.563	0.49	to	0.637	-0.951	0.479	0.687
							<0.001
NFS	0.550	0.476	to	0.186	0.784	0.325	<0.001
		0.624					

APRI	0.600	0.528 0.672	to 1.435	0.653	0.578	<0.001
ALT	0.688	0.62 to 0.756	18.5	0.663	0.663	<0.001
AST	0.583	0.513 0.654	to 20.5	0.574	0.59	<0.001
Anthropometric indices*	0.727	0.662 0.791	to /	0.700	0.687	<0.001
Anthropometric indices*+CTI	0.734	0.67 to 0.798	/	0.721	0.663	<0.001
Conventional risk factors <sup>#</sup>	0.679	0.61 to 0.749	/	0.737	0.578	<0.001
Conventional risk factors <sup>#</sup> +CTI	0.681	0.611 to 0.75	/	0.716	0.602	<0.001

\*Anthropometric indices: BMI, WC, HC, WHR, BRI

<sup>#</sup>Conventional risk factors: Age, Sex, Current smoking, Current drinking, Regular exercise, BMI, WC, HC, WHR, BRI, AST, ALT, TCHO, TG, HDL-C, FPG, SBP.

Abbreviations: receiver operating characteristic curve (ROC); area under the curve (AUC); confidence interval (CI); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); high-sensitivity C-reactive protein (hs-CRP); triglyceride–glucose index (TyG); Fibrosis-4 index (FIB-4); NAFLD fibrosis score (NFS); AST to platelet ratio index (APRI); alanine aminotransferase (ALT); aspartate aminotransferase (AST); body-mass index (BMI); waist circumference (WC); hip circumference (HC); Waist to hip ratio

(WHR); Body roundness index (BRI); total cholesterol (TCHO); triglycerides (TG); high-density lipoprotein cholesterol (HDL-C); fasting plasma glucose (FPG); systolic blood pressure (SBP); Normal glucose regulation (NGR); Prediabetes mellitus (Pre-DM); Diabetes mellitus (DM).

**Supplementary Table 3 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease after excluding current smokers**

Characteristic (N=2,962)	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
MASLD (N=1,366)						
CTI (per 1 unit)	5.86 (5.10 to 6.77)	<0.001	5.00 (4.32 to 5.79)	<0.001	3.07 (2.46 to 3.83)	<0.001
CTI quartile						
Q1	Ref.		Ref.		Ref.	
Q2	3.86 (3.07 to 4.87)	<0.001	3.34 (2.63 to 4.24)	<0.001	2.31 (1.78 to 3.01)	<0.001
Q3	10.70 (8.47 to 13.7)	<0.001	8.42 (6.57 to 10.78)	<0.001	3.73 (2.75 to 5.05)	<0.001
Q4	32.70 (24.40 to 44.30)	<0.001	23.40 (17.20 to 31.83)	<0.001	6.32 (4.12 to 9.70)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension,

history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein-triglyceride-glucose index (CTI); metabolic dysfunction-associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 4 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease in different glycemic status after excluding current smokers**

Characteristic	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
NGR (N = 1,281)						
CTI (per 1 unit)	5.51(4.39 to 6.99)	<0.001	4.36 (3.41 to 5.56)	<0.001	2.97 (2.04 to 4.32)	<0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	4.26 (3.06 to 5.99)	<0.001	3.66 (2.57 to 5.21)	<0.001	2.54 (1.70 to 3.79)	<0.001
Q3	10.70 (7.44 to 15.50)	<0.001	7.76 (5.26 to 11.43)	<0.001	3.55 (2.15 to 5.86)	<0.001
Q4	20.70 (12.30 to 36.10)	<0.001	12.55 (7.13 to 22.11)	<0.001	4.66 (2.07 to 10.48)	<0.001

<i>P</i> for trend	/	<0.001	/	<0.001	/	<0.001
Pre-DM (N = 1,372)						
CTI (per 1 unit)	5.50 (4.46 to 6.84)	<0.001	4.99 (4.02 to 6.20)	<0.001	3.59 (2.62 to 4.92)	<0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	2.92 (2.08 to 4.12)	<0.001	2.69 (1.90 to 3.81)	<0.001	2.02 (1.38 to 2.96)	<0.001
Q3	7.55 (5.38 to 10.70)	<0.001	6.66 (4.68 to 9.48)	<0.001	3.50 (2.30 to 5.32)	<0.001
Q4	28.20 (18.10 to 45.10)	<0.001	22.92 (14.43 to 36.41)	<0.001	9.66 (5.24 to 17.82)	<0.001
<i>P</i> for trend	/	<0.001	/	<0.001	/	<0.001
DM (N = 309)						
CTI (per 1 unit)	3.76 (2.59 to 5.65)	<0.001	3.62 (2.43-5.40)	0.509	1.84 (0.95-3.56)	0.930
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	3.26 (1.21 to 9.61)	<0.001	3.82 (1.31-11.08)	0.014	3.27 (0.95-11.23)	0.060
Q3	12.00 (4.45 to 36.0)	<0.001	13.90 (4.74-40.72)	<0.001	5.66 (1.52-20.99)	0.010
Q4	18.30 (7.28 to 51.00)	<0.001	18.75 (6.93-50.74)	<0.001	4.39 (1.09-17.63)	0.037
<i>P</i> for trend	/	<0.001	/	<0.001	/	0.074

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Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for

SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein-triglyceride-glucose index (CTI); metabolic dysfunction-associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 5 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease after excluding current drinkers**

Characteristic (N=2,965)	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
MASLD (N=1,358)						
CTI (per 1 unit)	6.05 (5.26 to 7.00)	<0.001	5.29 (4.57 to 6.11)	<0.001	3.19 (2.55 to 3.98)	<0.001
CTI quartile						
Q1	Ref.		Ref.		Ref.	
Q2	3.98 (3.15 to 5.06)	<0.001	3.46 (2.72 to 4.41)	<0.001	2.34 (1.79 to 3.06)	<0.001
Q3	10.30 (8.11 to 13.20)	<0.001	8.31 (6.47 to 10.67)	<0.001	3.57 (2.64 to 4.84)	<0.001
Q4	37.70 (28.00 to 51.30)	<0.001	27.97 (20.53 to 38.10)	<0.001	7.14 (4.65 to 10.95)	<0.001

*P* for trend / <0.001 / <0.001 / <0.001

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 6 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease in different glycemic status after excluding current drinkers**

Characteristic	Model 1		Model 2		Model 3	
	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value
NGR (N = 1,243)						
CTI (per 1 unit)	5.82 (4.61 to 7.44)	<0.001	4.73 (3.69 to 6.07)	0.004	3.11 (2.14 to 4.52)	0.004
CTI quartile						

Q1	Ref.	/	Ref.	/	Ref.	/
Q2	4.22 (2.99 to 6.01)	<0.001	3.56 (2.48 to 5.12)	<0.001	2.53 (1.68 to 3.80)	<0.001
Q3	10.50 (7.27 to 15.50)	<0.001	7.62 (5.14 to 11.30)	<0.001	3.50 (2.13 to 5.75)	<0.001
Q4	25.90 (15.10 to 45.90)	<0.001	16.82 (9.46 to 29.92)	<0.001	5.38 (2.39 to 12.12)	<0.001
<i>P</i> for trend	/	<0.001	/	<0.001	/	<0.001
Pre-DM (N =1,394 )						
CTI (per 1 unit)	5.80 (4.71 to 7.22)	<0.001	5.29 (4.27 to 6.57)	<0.001	3.51 (2.56 to 4.82)	<0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	3.13 (2.22 to 4.45)	<0.001	2.94 (2.07 to 4.17)	<0.001	2.05 (1.39 to 3.01)	<0.001
Q3	7.28 (5.16 to 10.40)	<0.001	6.55 (4.59 to 9.33)	<0.001	3.11 (2.04 to 4.75)	<0.001
Q4	32.80 (21.10 to 52.40)	<0.001	27.14 (17.13 to 42.99)	<0.001	9.76 (5.28 to 18.04)	<0.001
<i>P</i> for trend	/	<0.001	/	<0.001	/	<0.001
DM (N = 328)						
CTI (per 1 unit)	3.48 (2.45 to 5.12)	<0.001	3.32 (2.28 to 4.85)	<0.001	1.83 (0.99 to 3.38)	0.052
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	3.48 (1.31 to 10.10)	0.015	4.35 (1.52 to 12.44)	<0.001	3.52 (1.09 to 11.34)	<0.001
Q3	11.40 (4.26 to 33.90)	<0.001	12.88 (4.47 to 37.10)	<0.001	5.98 (1.72 to 20.79)	<0.001

Q4	18.70 (7.51 to 52.20)	<0.001	19.20 (7.15 to 51.53)	<0.001	4.95 (1.37 to 17.86)	<0.001
<i>P</i> for trend	/	<0.001	/	<0.001	/	0.040

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 7 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease after excluding obese individuals (body mass index  $\geq 28$  kg/m<sup>2</sup>)**

Characteristic (N=6,320)	Model 1		Model 2		Model 3	
	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value
MASLD (N=3,019)						
CTI (per 1 unit)	4.86 (4.44 to 5.32)	<0.001	4.75 (4.13 to 5.45)	<0.001	3.16 (2.56 to 3.91)	<0.001

CTI quartile						
Q1	Ref.		Ref.		Ref.	
Q2	3.24 (2.77 to 3.80)	<0.001	3.40 (2.68 to 4.30)	<0.001	2.40 (1.85 to 3.10)	<0.001
Q3	8.55 (7.28 to 10.10)	<0.001	7.61 (5.97 to 9.70)	<0.001	3.57 (2.67 to 4.77)	<0.001
Q4	25.00 (20.70 to 30.30)	<0.001	22.71 (16.91 to 30.52)	<0.001	6.75 (4.49 to 10.16)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein-triglyceride-glucose index (CTI); metabolic dysfunction-associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 8 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease in different glycemic status after excluding obese individuals (body mass index  $\geq 28$  kg/m<sup>2</sup>)**

Characteristic	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
NGR (N = 2,706)						
CTI (per 1 unit)	4.77 (4.13 to 5.53)	<0.001	4.08 (3.25 to 5.12)	<0.001	2.92 (2.07 to 4.13)	0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	3.53 (2.82 to 4.45)	<0.001	3.70 (2.62 to 5.23)	<0.001	2.64 (1.80 to 3.87)	<0.001
Q3	9.23 (7.23 to 11.80)	<0.001	6.75 (4.64 to 9.82)	<0.001	3.21 (2.01 to 5.12)	<0.001
Q4	19.70 (14.30 to 27.30)	<0.001	12.98 (7.78 to 21.66)	<0.001	5.13 (2.48 to 10.62)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001
Pre-DM (N = 2,910)						
CTI (per 1 unit)	4.71 (4.11 to 5.43)	<0.001	5.00 (4.05 to 6.18)	<0.001	3.72 (2.73 to 5.06)	<0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	2.66 (2.10 to 3.39)	<0.001	2.85 (2.02 to 4.03)	<0.001	2.19 (1.51 to 3.19)	<0.001
Q3	6.71 (5.30 to 8.55)	<0.001	6.57 (4.64 to 9.31)	<0.001	3.57 (2.38 to 5.37)	<0.001
Q4	20.40 (15.40 to 27.40)	<0.001	23.70 (15.15 to 37.10)	<0.001	10.15 (5.59 to 18.42)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001
DM (N = 704)						

CTI (per 1 unit)	3.03 (2.41 to 3.88)	<0.001	3.39 (2.33-4.93)	<0.001	1.74 (0.92-3.31)	0.090
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	1.84 (0.94 to 3.65)	0.077	3.52 (1.23-10.03)	0.018	2.30 (0.70-7.55)	0.168
Q3	3.65 (1.94 to 7.02)	<0.001	10.35 (3.61-29.61)	<0.001	3.97 (1.13-13.95)	0.031
Q4	10.90 (5.89 to 20.70)	<0.001	17.17 (6.40-46.04)	<0.001	3.59 (0.97-13.37)	0.056
<i>P</i> for trend	/	<0.001	/	<0.001	/	0.076

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 9 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease after excluding participants with acute**

**inflammation (white blood cell count >10 mg/L)**

Characteristic (N=7,304)	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
MASLD (N=3,977)						
CTI (per 1 unit)	5.31 (4.88 to 5.79)	<0.001	5.09 (4.46 to 5.81)	<0.001	3.32 (2.71 to 4.06)	<0.001
CTI quartile						
Q1	Ref.		Ref.		Ref.	
Q2	3.38 (2.91 to 3.92)	<0.001	3.37 (2.70 to 4.21)	<0.001	2.35 (1.84 to 3.00)	<0.001
Q3	9.07 (7.79 to 10.60)	<0.001	8.15 (6.48 to 10.25)	<0.001	3.69 (2.80 to 4.86)	<0.001
Q4	30.10 (25.10 to 36.20)	<0.001	25.65 (19.38 to 33.95)	<0.001	7.29 (4.95 to 10.74)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR);

glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 10 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease in different glycemic status after excluding participants with acute inflammation (white blood cell count >10 mg/L)**

Characteristic	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
NGR (N = 2,901)						
CTI (per 1 unit)	5.30 (4.61 to 6.13)	<0.001	4.41 (3.53 to 5.50)	<0.001	3.04 (2.17 to 4.26)	<0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	3.70 (2.98 to 4.60)	<0.001	3.72 (2.67 to 5.18)	<0.001	2.59 (1.79 to 3.76)	<0.001
Q3	10.00 (7.93 to 12.70)	<0.001	7.60 (5.32 to 10.87)	<0.001	3.43 (2.19 to 5.37)	<0.001
Q4	24.00 (17.60 to 33.10)	<0.001	14.40 (8.78 to 23.61)	<0.001	5.11 (2.51 to 10.40)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001
Pre-DM (N = 3,496)						
CTI (per 1 unit)	5.31 (4.88 to 5.79)	<0.001	5.16 (4.23 to 6.30)	<0.001	3.69 (2.76 to 4.93)	<0.001
CTI quartile						

Q1	Ref.	/	Ref.	/	Ref.	/
Q2	3.38 (2.91 to 3.92)	<0.001	2.74 (1.98 to 3.78)	<0.001	2.06 (1.45 to 2.93)	<0.001
Q3	9.07 (7.79 to 10.60)	<0.001	6.50 (4.69 to 9.01)	<0.001	3.38 (2.30 to 4.96)	<0.001
Q4	30.10 (25.10 to 36.20)	<0.001	25.32 (16.58 to 38.67)	<0.001	10.44 (5.95 to 18.31)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001
DM (N = 907)						
CTI (per 1 unit)	3.14 (2.51 to 3.93)	<0.001	3.48 (2.42 to 4.99)	<0.001	2.28 (1.25 to 4.17)	0.007
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	2.74 (0.80 to 10.50)	0.118	3.44 (1.27 to 9.30)	<0.001	3.07 (1.00 to 9.48)	0.051
Q3	6.17 (1.92 to 22.50)	0.003	10.94 (4.05 to 29.60)	<0.001	5.98 (1.84 to 19.42)	0.003
Q4	19.60 (6.13 to 72.30)	<0.001	17.54 (6.92 to 44.44)	<0.001	5.69 (1.68 to 19.27)	0.005
P for trend	/	0.118	/	<0.001	/	0.009

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Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP);

total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 11 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease after excluding those using lipid-lowering medications**

Characteristic (N=772)	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
MASLD (N=474)						
CTI (per 1 unit)	5.36 (4.11 to 7.11)	<0.001	5.16 (3.89 to 6.83)	<0.001	3.61 (2.32 to 5.61)	<0.001
CTI quartile						
Q1	Ref.		Ref.		Ref.	
Q2	3.68 (2.31 to 5.98)	<0.001	3.54 (2.17 to 5.78)	<0.001	2.50 (1.46 to 4.29)	<0.001
Q3	8.95 (5.53 to 14.80)	<0.001	8.16 (4.93 to 13.52)	<0.001	4.07 (2.22 to 7.47)	<0.001
Q4	30.90 (17.60 to 56.30)	<0.001	27.78 (15.39 to 50.15)	<0.001	8.71 (3.85 to 19.72)	<0.001
P for trend	/	<0.001	/	<0.001	/	<0.001

Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for

SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein-triglyceride-glucose index (CTI); metabolic dysfunction-associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).

**Supplementary Table 12 Logistic regression analyses the association between C-reactive protein-triglyceride-glucose index and metabolic dysfunction-associated steatotic liver disease in different glycemic status after excluding those using lipid-lowering medications**

Characteristic	Model 1		Model 2		Model 3	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
NGR (N = 202)						
CTI (per 1 unit)	5.74 (3.31 to 10.60)	<0.001	5.78 (3.05 to 10.94)	<0.001	5.79 (1.92 to 17.51)	0.002
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	5.80 (2.59 to 14.10)	<0.001	6.24 (2.52 to 15.50)	<0.001	5.89 (1.91 to 18.17)	0.002
Q3	10.30 (4.27 to 27.10)	<0.001	10.15 (3.77 to 27.36)	<0.001	5.55 (1.30 to 23.74)	0.021

Q4	29.90 (7.92 to 151.00)	<0.001	29.77 (6.34 to 139.85)	<0.001	19.84 (2.05 to 192.25)	0.010
<i>P</i> for trend	/	<0.001	/	<0.001	/	0.009
Pre-DM (N = 372)						
CTI (per 1 unit)	5.30 (3.56 to 8.18)	<0.001	5.20 (3.39 to 7.96)	<0.001	3.42 (1.82 to 6.44)	<0.001
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	2.68 (1.39 to 5.30)	0.004	2.62 (1.31 to 5.23)	0.006	1.81 (0.82 to 3.98)	0.141
Q3	7.38 (3.74 to 15.10)	<0.001	6.94 (3.39 to 14.19)	<0.001	3.62 (1.52 to 8.59)	0.004
Q4	24.70 (10.80 to 62.30)	<0.001	22.39 (9.20 to 54.47)	<0.001	7.39 (2.20 to 24.85)	0.001
<i>P</i> for trend	/	<0.001	/	<0.001	/	<0.001
DM (N = 198)						
CTI (per 1 unit)	3.98 (2.47 to 6.85)	<0.001	3.94 (2.34 to 6.63)	<0.001	3.00 (1.17 to 7.70)	0.022
CTI quartile						
Q1	Ref.	/	Ref.	/	Ref.	/
Q2	2.74 (0.80 to 10.50)	0.118	0.85 (0.13 to 5.82)	0.100	0.90 (0.13 to 6.34)	0.273
Q3	6.17 (1.92 to 22.50)	0.003	1.26 (0.20 to 8.17)	0.003	1.24 (0.20 to 8.21)	0.104
Q4	19.60 (6.13 to 72.30)	<0.001	1.58 (0.23 to 11.80)	<0.001	1.64 (0.23 to 12.70)	0.052
<i>P</i> for trend	/	<0.001	/	<0.001	/	0.050

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Odds ratios were estimated using the following models: Model 1: unadjusted for any covariates; Model 2: additionally

adjusted for age, sex, current smoking, current drinking, regular exercise; Model 3: Model 2 + additionally adjusted for SBP, DBP, HC, AST, TP, TBIL, DBIL, TCHO, HDL-C, LDL-C, PLT, ALB, HbA1c, eGFR, BUN, history of hypertension, history of hypertriglyceridemia, history of low HDL-cholesterol. Abbreviations: Odds ratio (OR); confidence interval (CI); quartile (Q); high-sensitivity C-reactive protein–triglyceride–glucose index (CTI); metabolic dysfunction–associated steatotic liver disease (MASLD); aspartate aminotransferase (AST); albumin (ALB); platelet count (PLT); total protein (TP); total bilirubin (TBIL); direct bilirubin (DBIL); blood urea nitrogen (BUN); estimated glomerular filtration rate (eGFR); glycated haemoglobin (HbA1c); total cholesterol (TCHO); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C); hip circumference (HC); systolic blood pressure (SBP); diastolic blood pressure (DBP).