

Novel Common Variants Associated with Obesity and Type 2 Diabetes Detected Using a cFDR Method

Qiang Zhang¹, Ke-Hao Wu², Jing-Yang He¹, Yong Zeng^{2,4}, Jonathan Greenbaum², Xin Xia¹, Hui-Min Liu¹, Wan-Qiang Lv¹, Xu Lin³, Wei-Dong Zhang¹, Yuan-Lin Xi¹, Xue-Zhong Shi¹, Chang-Qing Sun^{1*}, Hong-Wen Deng^{1,2*}

¹College of Public Health, Zhengzhou University, Zhengzhou, NO.100 Kexue Road, High-Tech Development Zone Of States, P.R.C

²Center for Bioinformatics and Genomics, School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA 70112, USA

³Department of Endocrinology and Metabolism, the Third Affiliated Hospital of Southern Medical University, Guang Zhou, P.R.C

⁴College of Sciences, Beijing Jiao Tong University, Beijing, China

***Corresponding author**

Chang-Qing Sun, Prof.

Department of Social Medicine and Health Management

College of Public Health, Zhengzhou University 100 Kexue Avenue

Zhengzhou, 450001, Henan, PR China

Phone: +86 371 67781926

Fax: +86 371 67781919

E-mail: suncq@zzu.edu.cn

Hong-Wen Deng, Prof.

Department of Epidemiology and Biostatistics

College of Public Health, Zhengzhou University 100 Kexue Avenue

Zhengzhou, 450001, Henan, PR China

Tulane Center of Bioinformatics and Genomics

Department of Biostatistics and Data Science

Tulane University School of Public Health and Tropical Medicine

New Orleans, LA 70112, USA

Email: hdeng2@tulane.edu

Supplemental Information

Table S1. Overlapped individuals between BMI and T2D in European descendants.

Table S2. Conditional FDR value for BMI given the T2D ($cFDR < 0.05$).

Table S3. SNPs in high LD ($R^2 > 0.6$) with BMI-associated loci

Table S4. Conditional FDR value for T2D given the BMI ($cFDR < 0.05$).

Table S5. SNPs in high LD ($R^2 > 0.6$) with T2D-associated loci

Figure S1. Stratified QQ plots. Upper Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) BMI as a function of significance of the association with ADHD, and in (right) ADHD as a function of significance of the association with BMI. Lower Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) BMI as a function of significance of the association with MDD, and in (right) MDD as a function of significance of the association with BMI.

Figure S2. Stratified QQ plots. Upper Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) T2D as a function of significance of the association with ADHD, and in (right) ADHD as a function of significance of the association with T2D. Lower Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) T2D as a function of significance of the association with MDD, and in (right) MDD as a function of significance of the association with T2D.

Figure S3. Protein-protein interactions between BMI-associated genes.

Figure S4. Protein-protein interactions between T2D-associated genes.

Table S1: Overlapped individuals between T2D and BMI in European descendants

study	Full Name	T2D	BMI
ARIC	Atherosclerosis Risk in Communities Study	cases,775;controls,7,159	8,108
deCODE	deCODE genetics sample set	cases,1,465;controls,23,194	26,799
PROMIS	Pakistan Risk of Myocardial Infarction Study	cases,2,361;controls,6,817	3,615
DGI	Diabetes Genetics Initiative of Broad Institute of Harvard and MIT, Lund University, and Novartis Institutes of BioMedical Research	cases,1,022;controls,1,075	cases,1,317;controls,1,088
FUSION	Finland-United States Investigation of NIDDM Genetics	cases,1,161;controls,1,174	cases,1,092;controls,1,171
NHS	The Nurses' Health Study	cases,1,467;controls,1,754	2,265
T2D_WTCCC	WTCCC Type 2 Diabetes cases	cases,1,924	cases,1,903

Table S2 Conditional FDR value for BMI given the T2D (cFDR < 0.05).

RSID	ROLE	GENE	CHR	SNP type	Gene type	P.valueA	cFDR.AcB
rs9930506	intronic	FTO	chr16	Confirmed	Confirmed	2.52E-124	1.01E-123
rs7531118	intergenic	NEGR1, LINC01360	chr1	Confirmed	Confirmed	1.88E-28	5.07E-24
rs1996023	intergenic	GNPDA2, GABRG1	chr4	Confirmed	Confirmed, confirmed	1.11E-20	1.93E-17
rs11672660	intronic	GIPR	chr19	Confirmed	Confirmed	7.91E-19	4.31E-15
rs7141420	intronic	NRXN3	chr14	Confirmed	Confirmed	8.66E-15	4.68E-13
rs1385912	intronic	NEGR1	chr1	Confirmed	Confirmed	5.79E-17	7.00E-13
rs1031477	intronic	NCKAP5L	chr12	Confirmed	Confirmed	4.87E-16	7.59E-13
rs2635727	intergenic	TFAP2B, PKHD1	chr6	Confirmed	Confirmed, confirmed	1.35E-15	1.25E-11
rs1849338	intergenic	GNPDA2, GABRG1	chr4	Confirmed	Confirmed, confirmed	5.09E-14	4.70E-11
rs7553348	intronic	FPGT-TNNI3K, TNNI3K	chr1	Confirmed	Confirmed, confirmed	4.40E-15	5.56E-11
rs2902210	intronic	SEC16B	chr1	Confirmed	Confirmed	3.37E-14	2.10E-10
rs12429545	intergenic	LINC01065, LINC00558	chr13	Confirmed	Confirmed, confirmed	3.15E-13	2.90E-10
rs12956917	intergenic	PMAIP1, MC4R	chr18	Confirmed	Confirmed, confirmed	2.09E-13	1.73E-09
rs3922668	intronic	SPNS1	chr16	Confirmed	Confirmed	7.95E-13	7.08E-09

rs11125884	ncRNA_intronic	DNAJC27-AS1	chr2	Confirmed	Confirmed	1.74E-12	8.98E-09
rs7939420	intronic	AGBL2	chr11	Confirmed	Confirmed	2.22E-12	9.91E-09
rs2060604	intergenic	HNF4G, LINC01111	chr8	Confirmed	Confirmed, confirmed	9.46E-12	4.12E-08
rs6548242	intergenic	FAM150B, TMEM18	chr2	Confirmed	Confirmed, confirmed	6.14E-11	9.28E-08
rs752720	intergenic	PMAIP1, MC4R	chr18	Confirmed	Confirmed, confirmed	6.63E-11	9.81E-08
rs10787472	intronic	TCF7L2	chr10	T2D (26551672)	Confirmed	3.25E-07	3.25E-07
rs4704220	intronic	COL4A3BP	chr5	LDL (20686565)	Confirmed	4.90E-10	8.96E-07
rs9540493	intergenic	LOC102723968, LINC01052	chr13	Confirmed	Confirmed, confirmed	3.95E-09	1.22E-06
rs16945088	intronic	FTO	chr16	Confirmed	Confirmed	5.30E-09	1.48E-06
rs6658131	intergenic	LOC101928241, PTBP2	chr1	Confirmed	Confirmed, confirmed	1.97E-09	1.52E-06
rs1032524	ncRNA_intronic	IPO9-AS1	chr1	Confirmed	Confirmed	5.64E-10	2.01E-06
rs4238585	intergenic	GPR139, GP2	chr16	Confirmed	Confirmed, confirmed	1.12E-08	3.02E-06
rs2881654	intronic	PPARG	chr3	Fasting insulin adjusted for BMI (22885924)	Confirmed	1.40E-06	4.19E-06
rs522367	intronic	SEC16B	chr1	Confirmed	Confirmed	1.97E-09	5.82E-06
rs815611	intergenic	MFAP3, GALNT10	chr5	Confirmed	Confirmed, confirmed	2.36E-08	8.50E-06
rs6713510	ncRNA_intronic	LOC646736	chr2	Confirmed	Confirmed	1.97E-08	8.62E-06
rs2038645	intergenic	LOC101928241,	chr1	Confirmed	Novel, confirmed	1.01E-08	9.37E-06

		PTBP2					
rs17217144	intronic	FTO	chr16	Confirmed	Confirmed	4.10E-08	9.96E-06
rs12986742	ncRNA_intronic	LINC01122	chr2	Confirmed	Confirmed	8.92E-09	1.13E-05
rs9958194	intergenic	PMAIP1, MC4R	chr18	Confirmed	Confirmed, confirmed	3.02E-08	1.15E-05
rs1275986	intergenic	CIB4, KCNK3	chr2	Confirmed	Novel, confirmed	4.88E-08	1.28E-05
rs1780050	intronic	NEXN	chr1	Confirmed	Confirmed	2.71E-08	2.01E-05
rs11755393	exonic	UHRF1BP1	chr6	Confirmed	Confirmed	2.43E-08	2.42E-05
rs891386	intronic	C18orf8	chr18	Confirmed	Confirmed	5.20E-08	2.90E-05
rs16952522	intronic	FTO	chr16	Confirmed	Confirmed	8.47E-08	2.94E-05
rs849135	intronic	JAZF1	chr7	Height (23754948)	Confirmed	1.45E-05	3.85E-05
rs2235569	intronic	C6orf106	chr6	LD	Confirmed	9.64E-08	6.26E-05
rs757318	intronic	CRTC1	chr19	Confirmed	Confirmed	3.18E-08	6.46E-05
rs17243334	intronic	MAP2K5	chr15	LD	Confirmed	3.09E-07	9.45E-05
rs6990042	intronic	SGCZ	chr8	Novel	Confirmed	4.48E-07	0.000165225
rs7503807	intronic	RPTOR	chr17	LD	Confirmed	5.73E-07	0.00017371
rs185350	downstream	KCTD15	chr19	BMI (23754948)	Confirmed	7.63E-08	0.000248708
rs4949662	intronic	ZZZ3	chr1	LD	Obesity (23563607)	4.98E-07	0.000278265
rs1222069	intergenic	LOC102723661, LOC101928241	chr1	Confirmed	Confirmed, novel	1.64E-06	0.000282799
rs7197983	intronic	FTO	chr16	Novel	Confirmed	2.05E-07	0.000292654
rs2335418	intergenic	ANKRD31, HMGCR	chr5	LDL/total cholesterol (20686565)	Confirmed, confirmed	6.88E-07	0.000303523
rs17584208	intergenic	PSRC1, MYBPHL	chr1	LDL/total cholesterol (20686565)	Confirmed, novel	4.58E-06	0.000306011

rs258496	intergenic	POC5, SV2C	chr5	LDL/total cholesterol (24097068)	Confirmed, novel	4.88E-07	0.000357566
rs6720683	intergenic	FAM150B, TMEM18	chr2	Novel	Novel, confirmed	2.33E-07	0.000368699
rs1440983	intergenic	PRKD1, G2E3	chr14	BMI (23754948)	Confirmed, novel	3.56E-06	0.000374722
rs11079813	intronic	SKAP1	chr17	Novel	Confirmed	2.95E-06	0.000376817
rs4481184	intronic	IGF2BP2	chr3	T2D (24509480)	Confirmed	0.0002524	0.0003786
rs11632574	intronic	MAP2K5	chr15	LD	Confirmed	1.67E-06	0.000414023
rs10840103	intergenic	TRIM66, RPL27A	chr11	LD	Confirmed, confirmed	1.74E-07	0.000427491
rs7239883	ncRNA_intronic	LINC00907	chr18	Confirmed	Confirmed	3.14E-07	0.000435037
rs12454712	intronic	BCL2	chr18	Waist hip ratio adjusted for BMI (25673412)	Confirmed	6.04E-06	0.000495526
rs6795735	ncRNA_intronic	ADAMTS9-AS 2	chr3	Waist hip ratio adjusted for BMI (25673412)	Confirmed	2.92E-05	0.00055499
rs11688816	intronic	EHBP1	chr2	Confirmed	Confirmed	3.80E-07	0.000573136
rs1861569	intergenic	MIR5095, CBLN1	chr16	LD	Novel, confirmed	5.67E-06	0.000575201
rs6864049	intergenic	ZNF608, LOC101927421	chr5	Waist circumference (25673412)	Confirmed, confirmed	2.12E-07	0.000624587
rs17110049	intergenic	STXBP6, NOVA1	chr14	Novel	Confirmed, confirmed	3.16E-07	0.00062492
rs405509	upstream	APOE	chr19	LDL cholesterol	Confirmed	2.65E-07	0.00067586

				(20686565)				
rs2270204	intronic	SWI5	chr9	Novel	Confirmed	3.22E-07	0.000726505	
rs740158	intergenic	LOC101927243, PTPN12	chr7	Novel	Novel, novel	3.98E-06	0.000738203	
rs1549979	intronic	CADM2	chr3	LD	Confirmed	2.71E-07	0.000749461	
rs1979755	intronic	KCNG3	chr2	Novel	Confirmed	4.33E-07	0.000950734	
rs4807191	intronic	BTBD2	chr19	Novel	Novel	7.47E-07	0.000955929	
rs9784046	intergenic	FAM150B, TMEM18	chr2	LD	Novel, confirmed	4.76E-07	0.000983564	
rs10499694	intronic	DDC	chr7	Novel	Confirmed	4.72E-07	0.000987047	
rs1546924	intronic	FAM212B	chr1	Novel	Confirmed	4.93E-06	0.000989891	
rs1561277	intronic	ZRANB3	chr2	Height (25282103)	Height (25282103)	7.85E-07	0.001078547	
rs7433760	intronic	ETV5	chr3	Novel	Confirmed	1.02E-06	0.001090877	
rs12681744	intergenic	HNF4G, LINC01111	chr8	Novel	Confirmed, hip circumference (25673412)	1.01E-06	0.001127745	
rs7633265	intronic	ACAP2	chr3	Novel	Confirmed	6.62E-07	0.001299579	
rs13432055	intronic	CCDC85A	chr2	Novel	Novel	1.14E-05	0.001313946	
rs998584	intergenic	, LINC01512	chr6	Waist hip ratio (25673412)	Confirmed, novel	2.89E-06	0.001315945	
rs227761	intronic	IQCK	chr16	Novel	Confirmed	3.81E-06	0.001455138	
rs4290163	intergenic	CYP17A1, BORCS7	chr10	Hip circumference (25673412)	Novel, novel	7.35E-07	0.00151012	
rs12895330	intergenic	AKAP6, NPAS3	chr14	Novel	Confirmed, confirmed	9.72E-05	0.00160413	
rs9381901	intergenic	TFAP2D, TFAP2B	chr6	LD	Confirmed, confirmed	1.77E-06	0.001629138	

rs12044597	intronic	NADK	chr1	Novel	Novel	1.01E-06	0.001646721
rs9408902	intergenic	ASTN2, LOC101928797	chr9	LD	Novel, confirmed	3.06E-06	0.001713757
rs3930017	intergenic	PMS2P9, CCDC146	chr7	Novel	Novel, novel	9.35E-07	0.001744005
rs4937993	intronic	NCAM1	chr11	Novel	Confirmed	4.70E-06	0.001846511
rs2444217	intronic	ADCY9	chr16	Novel	Confirmed	1.92E-06	0.001940733
rs6730157	intronic	RAB3GAP1	chr2	Height (25282103)	Confirmed	2.04E-06	0.002005948
rs12127789	intronic	NEGR1	chr1	LD	Confirmed	1.54E-05	0.00203588
rs7232886	intergenic	PMAIP1, MC4R	chr18	LD	Confirmed, confirmed	1.53E-06	0.002068537
rs4988235	intronic	MCM6	chr2	Hip circumference (25673412)	Confirmed	2.14E-06	0.002069618
rs7551794	intergenic	PTBP2, DPYD	chr1	Novel	Confirmed, confirmed	3.81E-06	0.002080004
rs12447481	intronic	FTO	chr16	Novel	Confirmed	1.30E-05	0.002233689
rs6465468	UTR3	ASB4	chr7	Confirmed	Confirmed	2.44E-06	0.00240137
rs4809401	exonic	NPBWR2	chr20	Novel	Confirmed	7.51E-06	0.002417407
rs4771946	intronic	HS6ST3	chr13	LD	Confirmed	2.57E-06	0.00256469
rs751008	intronic	DOCK1	chr10	Novel	Confirmed	1.64E-06	0.002861018
rs2685230	intergenic	FAM150B, TMEM18	chr2	Novel	Novel, confirmed	4.88E-06	0.00286647
rs4304326	intergenic	DUSP26, LINC01288	chr8	Novel	Confirmed, confirmed	9.32E-06	0.002929285
rs2074120	intronic	CALCR	chr7	Novel	Confirmed	8.81E-06	0.002932137
rs4667682	intergenic	TLK1,	chr2	Novel	Novel, confirmed	3.43E-06	0.0030852

		METTL8					
rs9659092	intronic	AGBL4	chr1	LD	Confirmed	1.86E-06	0.003136918
rs7748777	intergenic	TREM2, TREML2	chr6	Novel	Novel, novel	1.27E-05	0.003178313
rs7228347	intergenic	MC4R, CDH20	chr18	LD	Confirmed, novel	9.41E-06	0.003254209
rs10971712	intronic	UBE2R2	chr9	Novel	Confirmed	1.51E-05	0.003293576
rs12598706	intronic	PDILT	chr16	Novel	Novel	4.34E-06	0.003310199
rs17700028	intergenic	PMAIP1, MC4R	chr18	Novel	Confirmed, confirmed	2.63E-05	0.003315913
rs2665357	intronic	SLC22A3	chr6	Triglycerides (24097068)	Confirmed	2.17E-05	0.003381668
rs10850838	intergenic	MIR4497, GLTP	chr12	Novel	Novel, novel	2.49E-05	0.003760116
rs11786541	intergenic	MIR124-1, MSRA	chr8	Novel	Novel, novel	6.20E-05	0.003802053
rs1225051	intronic	CPNE4	chr3	Novel	Novel	5.23E-06	0.003898182
rs1433075	intronic	ZNF536	chr19	Novel	Confirmed	1.53E-05	0.00418506
rs17594321	intronic	ICA1L	chr2	Novel	Novel	4.10E-05	0.00433728
rs2150855	intronic	LINGO2	chr9	Novel	Confirmed	3.52E-06	0.004399431
rs10934987	intronic	CPNE4	chr3	Novel	Confirmed	5.03E-05	0.004563173
rs17049738	ncRNA_intronic	LINC01122	chr2	Novel	Confirmed	4.36E-05	0.004600947
rs9357506	intronic	RCAN2	chr6	Novel	Confirmed	6.80E-06	0.004685473
rs17326595	intergenic	KCTD15, LSM14A	chr19	LD	Confirmed, novel	3.44E-06	0.004839931
rs7586043	intergenic	LINC01320,	chr2	Novel	Novel, confirmed	3.94E-05	0.005117885

LOC100288911							
rs2280018	intronic	PDXDC1	chr16	Novel	Confirmed	4.70E-05	0.005435586
rs9639027	upstream	ZNF12	chr7	Novel	Confirmed	4.50E-06	0.005515095
rs10069222	intronic	SLIT3	chr5	Novel	Novel	0.0001328	0.006049778
rs718947	intronic	CTBP2	chr10	Novel	Confirmed	6.51E-06	0.006061564
rs11064524	intronic	WNK1	chr12	Novel	Confirmed	5.16E-06	0.0063081
rs3814878	UTR5	FAM57B	chr16	LD	Novel	2.80E-05	0.0063371
rs1783598	intronic	FCHSD2	chr11	Fasting glucose (22885924)	Fasting glucose (22885924)	0.0003666	0.006435867
rs2033530	downstream	TDRG1	chr6	Novel	Confirmed	8.22E-06	0.00650742
rs12465802	intronic	R3HDM1	chr2	Height (25282103)	Height (25282103)	9.85E-06	0.006633446
rs11066301	intronic	PTPN11	chr12	Total cholesterol (20686565)	Total cholesterol (20686565)	6.32E-06	0.006673692
rs6723710	ncRNA_intronic	LINC01122	chr2	Novel	Confirmed	1.00E-05	0.006707388
rs9296115	intronic	PACSIN1	chr6	Novel	Novel	6.80E-06	0.007031531
rs11022762	intronic	ARNTL	chr11	Novel	Confirmed	1.95E-05	0.007220381
rs285556	intronic	PDZRN4	chr12	Novel	Confirmed	6.80E-06	0.007611221
rs10760450	UTR3	LMX1B	chr9	Novel	Confirmed	7.69E-06	0.007660047
rs3922649	intergenic	LOC101928778, SEC16B	chr1	Novel	Confirmed, confirmed	6.72E-06	0.00766394
rs1899689	intronic	CADPS2	chr7	Novel	Novel	6.68E-05	0.007969874
rs3756784	upstream	MED23	chr6	Novel	Novel	0.0001189	0.008434906
rs7970953	intronic	SOX5	chr12	Novel	Confirmed	1.52E-05	0.00878693
rs836964	intronic	FAIM2	chr12	Novel	Confirmed	8.05E-06	0.008812782
rs4686734	intergenic	ETV5, DGKG	chr3	Novel	Confirmed, confirmed	2.96E-05	0.009353304

rs1609761	intronic	REXO1	chr19	Novel	Novel	3.62E-05	0.009428682
rs7594432	intronic	DNMT3A	chr2	Height (25282103)	Confirmed	4.62E-05	0.009457659
rs823130	intronic	NUCKS1	chr1	Novel	Novel	0.0001112	0.009567833
rs763310	intronic	KDM1A	chr1	Novel	Novel	1.04E-05	0.009579896
rs8087237	intronic	PTPN2	chr18	Novel	Confirmed	8.37E-06	0.009581891
rs7239114	intergenic	ZBTB7C, CTIF	chr18	Novel	Novel, novel	3.58E-05	0.009653323
rs11625620	intronic	NRXN3	chr14	Novel	Confirmed	1.03E-05	0.009673169
rs3752904	exonic	ECE2	chr3	Novel	Novel	4.81E-05	0.009763351
rs2225203	intergenic	LINC01065, LINC00558	chr13	Novel	Novel, novel	1.47E-05	0.009920883
rs8048267	intronic	ZFHX3	chr16	Novel	Confirmed	6.15E-05	0.009988875
rs10913472	intronic	SEC16B	chr1	Novel	Confirmed	1.08E-05	0.010480014
rs10774625	intronic	ATXN2	chr12	Novel	Confirmed	1.28E-05	0.010884146
rs10932150	exonic	ZDBF2	chr2	Novel	Confirmed	8.98E-05	0.011110275
rs17819063	intronic	FTO	chr16	Novel	Confirmed	1.07E-05	0.011420296
rs825461	intronic	ZNF664, FAM101A	chr12	Waist hip ratio adjusted for BMI in females greater than 50 years of age (26426971)	Confirmed, confirmed	0.0003917	0.01143764
rs6510001	intergenic	URI1, ZNF536	chr19	Novel	Novel, confirmed	2.73E-05	0.011439555
rs1473	intronic	PUM1	chr1	Novel	Novel	0.0004889	0.01144026
rs2334255	UTR3	GIPR	chr19	Novel	Confirmed	0.0008051	0.011450311
rs11925138	intronic	CPNE4	chr3	Novel	Confirmed	7.69E-05	0.011637533
rs882386	intronic	DMXL2	chr15	Novel	Confirmed	2.14E-05	0.011834154

rs4717540	intronic	AUTS2	chr7	Novel	Confirmed	0.0001241	0.012437147
rs17783165	intronic	CDH7	chr18	Novel	Confirmed	0.0001871	0.0127228
rs17211262	intergenic	MMD, TMEM100	chr17	Novel	Confirmed, novel	7.06E-05	0.012791893
rs4796221	intergenic	TBC1D3B, ZNHIT3	chr17	Novel	Novel, novel	7.06E-05	0.013475342
rs2161767	intergenic	MIR1302-4, CREB1	chr2	Novel	Novel, confirmed	1.47E-05	0.013701993
rs4980550	intergenic	MYEOV, LINC01488	chr11	Novel	Confirmed, novel	1.67E-05	0.013717911
rs329655	intergenic	IGSF9B, LOC100128239	chr11	Novel	Novel, novel	5.71E-05	0.013987777
rs2012284	intronic	ANAPC4	chr4	Novel	Novel	0.0002204	0.014798286
rs7161194	downstream	MIR377	chr14	Novel	Novel	3.02E-05	0.014800976
rs17644631	intergenic	LOC101927285, MIR4432HG	chr2	Novel	Confirmed, novel	0.000131	0.0148816
rs16969473	intronic	GPR139	chr16	Novel	Confirmed	3.36E-05	0.014918456
rs984677	intergenic	CASC20, BMP2	chr20	Height (23754948)	Confirmed, confirmed	5.63E-05	0.015038298
rs2965189	intronic	GATAD2A	chr19	Total cholesterol (24097068)	Height (25282103)	0.0002017	0.015311661
rs283553	intergenic	TFAP2B, PKHD1	chr6	LD	Confirmed, novel	1.69E-05	0.015442775
rs2677031	intergenic	CALCR, MIR4652	chr7	Novel	Confirmed, novel	1.63E-05	0.01561346
rs12104582	intergenic	LOC400940,	chr2	LD	Confirmed, hip circumference	0.0001975	0.01570125

		LINC01247			(25673412)		
rs2770102	ncRNA_intronic	CASC15	chr6	Novel	Confirmed	1.66E-05	0.01586085
rs3776569	intronic	SLC1A3	chr5	Novel	Novel	4.80E-05	0.015938517
rs6060001	intronic	TP53INP2	chr20	Height (25282103)	Height (25282103)	0.0003549	0.01604655
rs3818717	exonic	RAI1	chr17	Novel	Novel	0.0003603	0.016049727
rs12129408	intergenic	ADGRL2, LINC01361	chr1	Novel	Novel, novel	1.97E-05	0.016094004
rs889203	intronic	GPR139	chr16	LD	Confirmed	3.04E-05	0.016683789
rs10775267	intergenic	GPR139, GP2	chr16	Novel	Confirmed, confirmed	0.0002636	0.01690335
rs11674696	intergenic	MIR1302-4, CREB1	chr2	Novel	Novel, confirmed	2.76E-05	0.017081996
rs10271989	ncRNA_intronic	LOC101928782	chr7	Novel	Novel	0.0001902	0.017264308
rs1320252	intergenic	MAP2K3, KCNJ12	chr17	LD	Confirmed, confirmed	3.55E-05	0.017606529
rs2903940	intronic	EYA2	chr20	Novel	Confirmed	0.0002556	0.017729345
rs9322955	intergenic	NFKBIA, INSM2	chr14	Novel	Confirmed, novel	2.74E-05	0.019324319
rs10514944	intronic	SKAP1	chr17	Novel	Confirmed	0.0002798	0.019332431
rs231976	intergenic	IL27, NUPR1	chr16	Novel	Novel, novel	2.14E-05	0.019340286
rs2457831	intergenic	INADL, L1TD1	chr1	Novel	Confirmed, novel	2.27E-05	0.019389345
rs6904716	intronic	LEMD2	chr6	Novel	Confirmed	0.0001121	0.019463133
rs3759579	upstream	MARK3	chr14	Novel	Novel	2.18E-05	0.019637877
rs836525	intronic	DAGLB	chr7	Novel	Novel	5.83E-05	0.019785293
rs941737	intergenic	STXBP6, NOVA1	chr14	Novel	Confirmed, confirmed	8.98E-05	0.020287948

rs12406019	intergenic	GIPC2, MGC27382	chr1	Hip circumference in females (25673412)	Height (25282103), novel	2.61E-05	0.021112019
rs6766759	intronic	FAM19A1	chr3	Novel	Novel	5.55E-05	0.021609989
rs2524099	downstream	HLA-C	chr6	Novel	Novel	2.63E-05	0.022061256
rs10114139	intergenic	STRBP, CRB2	chr9	Novel	Novel, confirmed	0.0003249	0.02239245
rs6867577	intronic	FBXL17	chr5	Novel	Confirmed	4.18E-05	0.022967669
rs756717	intronic	ZFH3	chr16	Novel	Confirmed	7.85E-05	0.022986011
rs11037685	intergenic	HSD17B12, ALKBH3	chr11	Novel	Confirmed, novel	8.55E-05	0.02308269
rs11100760	intronic	INPP4B	chr4	Novel	Novel	0.0001477	0.023176989
rs9450537	intergenic	SNHG5, HTR1E	chr6	Novel	Novel, novel	0.0001392	0.023706533
rs11075994	intronic	FTO	chr16	Novel	Confirmed	0.0001272	0.0240408
rs11755266	intergenic	TCP11, SCUBE3	chr6	Height (23754948)	Height (18391951)	9.96E-05	0.024225664
rs17667540	ncRNA_intronic	SCHLAP1	chr2	Novel	Confirmed	0.0001953	0.024264217
rs2273684	intronic	GSS	chr20	Height (25282103)	Height (25282103)	0.0003858	0.024621055
rs2280406	upstream	MST1R	chr3	Novel	Novel	5.63E-05	0.02479517
rs12436181	intronic	TRAF3	chr14	Novel	Confirmed	0.0001721	0.024848825
rs12912380	intronic	SEMA6D	chr15	Novel	Confirmed	5.63E-05	0.0251098
rs12245680	intronic	TCF7L2	chr10	T2D (24509480)	Confirmed	0.01444	0.02527
rs1015055	intronic	NTM	chr11	Novel	Confirmed	0.0003049	0.025481855
rs10838708	intronic	PSMC3	chr11	Height (25282103)	Height (25282103)	3.63E-05	0.025743288
rs1604038	intergenic	EIF5A2, SLC2A2	chr3	Fasting glucose (22885924)	Novel, confirmed	0.001247	0.026394833

rs9512670	intergenic	RASL11A, GTF3A	chr13	Novel	Novel, confirmed	0.0001385	0.026899036
rs7612543	intronic	ZBTB38	chr3	Height (25282103)	Confirmed	0.0001385	0.027807901
rs500422	UTR5	USP37	chr2	Height (25282103)	Confirmed	3.49E-05	0.028400844
rs12923427	intergenic	XYLT1, NPIPA8	chr16	Novel	Novel, novel	0.0006042	0.028822578
rs716591	intergenic	MCTP2, LOC440311	chr15	Novel	Confirmed, novel	0.0003772	0.028859498
rs1593374	ncRNA_intronic	LOC102724623	chr8	Novel	Confirmed	0.000196	0.029176438
rs1500486	intergenic	GNPDA2, GABRG1	chr4	Novel	Confirmed, novel	6.33E-05	0.029356162
rs17231277	intergenic	LOC101928435, PSMG1	chr21	Novel	Novel, novel	3.68E-05	0.029578488
rs2886070	intergenic	ARHGEF2, SSR2	chr1	Novel	Novel, novel	0.0002133	0.030396672
rs10470517	intergenic	DNAJC19, SOX2-OT	chr3	Novel	Novel, novel	9.86E-05	0.030676193
rs1434285	intergenic	AMIGO1, GPR61	chr1	Novel	Novel, confirmed	0.0001318	0.031080446
rs7689420	intronic	HHIP	chr4	Height (25282103)	Confirmed	0.000124	0.031907087
rs879070	intronic	DENND1A	chr9	Novel	Confirmed	0.0009762	0.031957705
rs2488071	intergenic	HHEX, EXOC6	chr10	Novel	Confirmed, confirmed	0.006642	0.032103
rs16850638	intergenic	MIR548A3, ALCAM	chr3	Novel	Novel, confirmed	0.00012	0.032544255
rs6747219	ncRNA_intronic	LINC01122	chr2	Novel	Confirmed	0.0002862	0.032587773

rs2306369	exonic	KIAA1109	chr4	Novel	Novel	0.0002967	0.033628952
rs704084	intergenic	DUSP6, POC1B	chr12	Novel	Novel, novel	5.39E-05	0.034126828
rs11979110	intergenic	KLF14, MIR29A	chr7	HDL/HDL cholesterol (24097068)	Confirmed, novel	0.00288	0.03456
rs2862299	intronic	SEC16B	chr1	Novel	Confirmed, confirmed	0.0001289	0.03521574
rs621042	intronic	PIK3C2G	chr12	Novel	Confirmed	5.03E-05	0.035303938
rs2212450	intergenic	LOC387810, LOC101928847	chr11	Novel	Novel, novel	5.03E-05	0.035350484
rs10853100	intergenic	LOC101927166, HOXB1	chr17	Novel	Novel, novel	5.63E-05	0.035800418
rs6474952	intronic	CCDC171	chr9	LD	Confirmed	0.0001975	0.035949202
rs12050677	intronic	OTUD7A	chr15	Novel	Novel	0.0004653	0.0359691
rs3814614	intergenic	GRID1, WAPL	chr10	Novel	Confirmed, novel	0.001154	0.0360625
rs732310	intronic	REXO1	chr19	Novel	Novel	0.0001545	0.036143822
rs4329699	intronic	NTM	chr11	Novel	Confirmed	0.0004894	0.036563986
rs2100814	intergenic	ELP3, PNOC	chr8	Novel	Confirmed, novel	0.001864	0.036993231
rs10898868	intronic	ARAP1	chr11	log(Proinsulin) (21873549)	Confirmed	0.002589	0.0370227
rs214246	intronic	AXIN1	chr16	Novel	Confirmed	0.0001545	0.037419608
rs6500208	intergenic	MIR5095, CBLN1	chr16	Novel	Novel, confirmed	5.56E-05	0.037479969
rs834027	intronic	UBAP2	chr9	Novel	Novel	0.001299	0.037598833
rs2505276	intergenic	TFAP2B, PKHD1	chr6	LD	Confirmed, novel	5.16E-05	0.037811686
rs3803522	ncRNA_exonic	LOC101929076	chr15	Novel	Novel	0.0001039	0.039104627

rs1078101	intergenic	HAAO, LOC102723854	chr2	Novel	Novel, novel	0.0001768	0.0392548
rs6021796	intergenic	ZFP64, LINC01524	chr20	Novel	Confirmed, novel	0.0001768	0.03926728
rs12066815	intronic	NTNG1	chr1	Novel	Novel	9.19E-05	0.03936521
rs4414033	intergenic	C1orf61, MEF2D	chr1	Novel	Novel, novel	7.78E-05	0.039446552
rs4978760	intronic	IKBKAP	chr9	Novel	Novel	0.0005474	0.039728251
rs13337591	intronic	FTO	chr16	Novel	Confirmed	6.53E-05	0.039910651
rs2550739	intergenic	MIR4720, CMIP	chr16	Novel	Novel, confirmed	0.0001472	0.039915508
rs4809440	intergenic	SLC17A9, BHLHE23	chr20	Novel	Novel, novel	0.0005606	0.040829051
rs8001047	intergenic	PDS5B, LINC00423	chr13	Novel	Confirmed, novel	0.001864	0.040883733
rs11815022	intronic	PAX2	chr10	Novel	Confirmed	6.33E-05	0.040918054
rs7020269	intergenic	C9orf72, LINGO2	chr9	Novel	Novel, confirmed	0.001427	0.041065889
rs1037954	ncRNA_intronic	LOC101927314, MIR548H3	chr6	Novel	Confirmed, novel	6.33E-05	0.041476895
rs7801936	intronic	FKBP6	chr7	Novel	Novel	0.0007047	0.041705427
rs1993414	intergenic	TMEM26-AS1, C10orf107	chr10	Novel	Novel, novel	0.0001133	0.041955785
rs1320366	intergenic	FAM150B, TMEM18	chr2	LD	Novel, confirmed	6.87E-05	0.042030092

rs7821182	intergenic	LINC01419, RALYL	chr8	LD	Novel, confirmed	6.33E-05	0.042750496
rs8101491	intronic	SAE1	chr19	Novel	Novel	8.74E-05	0.043578635
rs1008007	intronic	LTBP2	chr14	Novel	Novel	7.12E-05	0.044755282
rs3750450	exonic	EPB41L4B	chr9	Novel	Confirmed	0.0007529	0.045174
rs305002	intergenic	LINC00593, TLE3	chr15	Novel	Novel, novel	0.0006339	0.045332654
rs7972585	intergenic	MVK, FAM222A	chr12	Novel	Novel, novel	9.42E-05	0.045396751
rs3784635	exonic	VPS13C	chr15	Novel	Confirmed	0.001758	0.0455908
rs2018218	intronic	NCR3LG1	chr11	Novel	Novel	0.0006148	0.045596263
rs2710508	intronic	EPHA4	chr2	Novel	Confirmed	6.85E-05	0.045740872
rs10228276	downstream	HOTTIP	chr7	Novel	Novel	0.0001161	0.046225662
rs11211176	intergenic	IPP, MAST2	chr1	Height (25282103)	Novel, confirmed	0.0004653	0.046248371
rs534523	intergenic	MIR124-1, MSRA	chr8	Novel	Novel, adiposity (19557161)	0.001566	0.0466668
rs605765	intergenic	KCNA4, FSHB	chr11	Novel	Novel, confirmed	0.0002843	0.046693314
rs2485534	intronic	GRIN3A	chr9	Novel	Novel	0.001696	0.0468096
rs4678856	intergenic	ARPP21, STAC	chr3	Novel	Novel, confirmed	8.00E-05	0.047525111
rs4474658	intergenic	C2CD4A, C2CD4B	chr15	log(Proinsulin) (21873549)	Height (20881960), confirmed	0.009024	0.048987429
rs1438995	intergenic	LINC00936, LINC00615	chr12	Novel	Novel, novel	9.72E-05	0.048996122
rs3911565	intronic	FAT3	chr11	Novel	Glucose homeostasis traits (25524916)	0.0006653	0.049335883

rs4937729	intronic	OPCML	chr11	Novel	Novel	0.001046	0.049390813
rs2275003	intronic	DCAF12	chr9	Novel	Novel	0.0004117	0.049943469

Notes:

SNP type means whether SNPs identified in our study compared to the original BMI GWAS and previous studies are Novel or Confirmed or associated with BMI-related traits (trait (PMID)) or in high LD with BMI-associated loci.

Gene type means whether genes identified in our study compared to the original BMI GWAS and previous studies are Novel or Confirmed.

P.valueA is the p value of BMI, A is BMI.

cFDR.AcB is the cFDR value of BMI conditioned on T2D, B is T2D.

Table S3 SNPs in high LD ($R^2 > 0.6$) with BMI-associated loci

SNP	R2	Proxy SNP	PMID	Trait
rs2235569	0.962	rs2814992	GIANT (25673413)	BMI
rs17243334	0.675	rs997295	GIANT (25673413)	BMI
rs7503807	0.967	rs12940622	GIANT (25673413)	BMI
rs4949662	0.933	rs17381664	GIANT (25673413)	BMI
rs11632574	0.677	rs8032675	GIANT (25673413)	BMI
rs10840103	0.848	rs4929949	Wheeler E (23563609)	Extreme obesity with early age of onset
rs1861569	0.933	rs2908884	GIANT (25673413)	BMI
rs1549979	0.665	rs12637027	GIANT (25673413)	BMI
rs9784046	0.633	rs12714412	GIANT (25673413)	BMI
rs9381901	1	rs2744489	GIANT (25673413)	BMI
rs9408902	1	rs1928295	GIANT (25673413)	BMI
rs12127789	0.851	rs12134600	GIANT (25673413)	BMI
rs7232886	1	rs8085349	GIANT (25673413)	BMI
rs4771946	0.818	rs9634490	GIANT (23563607)	Obesity
rs9659092	0.836	rs11583200	GIANT (25673413)	BMI
rs7228347	0.789	rs17066856	GIANT (25673413)	BMI
rs17326595	0.647	rs448376	GIANT (23563607)	Overweight
rs3814878	0.65	rs12325539	GIANT (25282103)	height
rs283553	0.658	rs4711966	GIANT (25673413)	BMI
rs12104582	0.964	rs10929925	GIANT (25673412)	Hip circumference

rs889203	0.774	rs11074422	GIANT (25673413)	BMI
rs1320252	0.866	rs1914888	GIANT (25282103)	Height
rs6474952	0.755	rs4740619	GIANT (25673413)	BMI
rs2505276	0.655	rs12529657	GIANT (25673413)	BMI
rs1320366	0.737	rs10209658	GIANT (25673413)	BMI
rs7821182	0.726	rs2033732	GIANT (25673413)	BMI

Table S4 Conditional FDR value for T2D given the BMI (cFDR < 0.05).

RSID	ROLE	GENE	CHR	SNP type	Gene type	P.valueB	cFDR.BcA
rs10787472	intronic	TCF7L2	chr10	Confirmed	Confirmed	1.30E-36	6.63E-35
rs4481184	intronic	IGF2BP2	chr3	Confirmed	Confirmed	4.50E-22	6.55E-20
rs6906327	intronic	CDKAL1	chr6	Confirmed	Confirmed	1.10E-23	1.82E-19
rs9930506	intronic	FTO	chr16	BMI (25673413)	Confirmed	1.90E-10	1.90E-10
rs849135	intronic	JAZF1	chr7	T2D (22885922)	Confirmed	1.70E-09	7.08E-08
rs2881654	intronic	PPARG	chr3	Confirmed	Confirmed	3.40E-09	7.82E-08
rs12245680	intronic	TCF7L2	chr10	Confirmed	Confirmed	1.10E-09	6.70E-07
rs163177	intronic	KCNQ1	chr11	Confirmed	Confirmed	2.00E-10	2.10E-06
rs4430796	intronic	HNF1B	chr17	T2D (26551672)	Confirmed	8.90E-10	9.19E-06
rs6103716	intronic	HNF4A	chr20	Confirmed	Confirmed	6.90E-09	1.27E-05
rs10811658	intergenic	CDKN2B-AS1, DMRTA1	chr9	Confirmed	Confirmed	5.00E-08	9.08E-05
rs12624485	intergenic	FITM2, R3HDML	chr20	Confirmed	Confirmed	2.00E-08	0.000131
rs4812831	ncRNA_intronic	HNF4A-AS1	chr20	Novel	Novel	1.20E-07	0.000209
rs7119	UTR3	HMG20A	chr15	Novel	Confirmed	6.50E-08	0.000264
rs3843467	intronic	C5orf67	chr5	Triglycerides (20686565)	Novel	2.40E-07	0.000293
rs7079711	intronic	TCF7L2	chr10	Novel	Confirmed	2.40E-07	0.000339
rs4753073	intergenic	MTNR1B, SLC36A4	chr11	Fasting glucose (20081858)	Confirmed, novel	5.70E-07	0.000373
rs17013383	ncRNA_intronic	MIR548AC	chr3	T2D (22158537)	Confirmed	5.50E-07	0.000549

rs2283228	intronic	KCNQ1	chr11	LD	Confirmed	7.20E-08	0.000628
rs2488071	intergenic	HHEX, EXOC6	chr10	Novel	Confirmed	4.70E-06	0.001119
rs7141420	intronic	NRXN3	chr14	BMI (25673413)	BMI (25673413)	0.00025	0.001125
rs6885904	ncRNA_intronic	ZBED3-AS1	chr5	Novel	Confirmed	1.50E-06	0.00173
rs4686698	intronic	IGF2BP2	chr3	Novel	Confirmed	1.70E-06	0.001765
rs231354	ncRNA_exonic	KCNQ1OT1	chr11	Novel	Confirmed	4.60E-07	0.001934
rs11514706	intergenic	DGKB, AGMO	chr7	Fasting glucose (20081858)	Confirmed, confirmed	2.20E-06	0.002021
rs3130931	UTR5	POU5F1	chr6	Height (25282103)	Confirmed	5.10E-06	0.002127
rs10885414	intronic	TCF7L2	chr10	Novel	Confirmed	1.00E-05	0.003658
rs2291720	intergenic	ZNF385D-AS2, UBE2E2	chr3	T2D (22158537)	Confirmed, confirmed	4.60E-06	0.003868
rs6991067	intronic	INTS8	chr8	LD	Confirmed	3.00E-06	0.005432
rs12217971	intergenic	CDC123, CAMK1D	chr10	Novel	Confirmed	8.70E-06	0.005586
rs6795735	ncRNA_intronic	ADAMTS9-AS2	chr3	T2D (22885922)	Confirmed	2.00E-04	0.00604
rs17150816	intergenic	MIR124-1, MSRA	chr8	Novel	Novel, novel	5.50E-06	0.006156
rs12895330	intergenic	AKAP6, NPAS3	chr14	Novel	Novel, novel	0.00021	0.007245
rs3892710	intergenic	HLA-DQB1, HLA-DQA2	chr6	T1D (17632545)	Confirmed, confirmed	2.10E-05	0.007928
rs234857	intronic	KCNQ1	chr11	Novel	Confirmed	8.50E-06	0.008189
rs17791633	intergenic	LOC101927450, TLE4	chr9	LD	Confirmed, confirmed	1.90E-06	0.008887
rs7965349	intronic	OASL	chr12	LD	Confirmed	2.80E-06	0.008893
rs1019029	intergenic	ARL4A, ETV1	chr7	Novel	Novel, novel	1.10E-05	0.009012

rs2327778	intergenic	SLC35D3, NHEG1	chr6	Novel	Confirmed, novel	5.30E-06	0.009304
rs2789686	UTR3	ANXA11	chr10	Novel	Novel	1.30E-05	0.01137
rs7812465	intronic	NDUFAF6	chr8	LD	Confirmed	2.40E-06	0.011919
rs11659412	intronic	LAMA1	chr18	LD	Confirmed	8.60E-06	0.013306
rs17013152	ncRNA_intronic	MIR548AC	chr3	LD	Novel	2.70E-05	0.013819
rs11979110	intergenic	KLF14, MIR29A	chr7	HDL (20686565)	Confirmed, novel	9.70E-05	0.014097
rs2540074	intronic	STRBP	chr9	Novel	Novel	6.50E-05	0.014357
rs7026633	intergenic	LOC101927450, TLE4	chr9	Novel	Confirmed, confirmed	1.00E-05	0.017157
rs290483	intronic	TCF7L2	chr10	Novel	Confirmed	1.70E-05	0.017162
rs530703	intergenic	NPBWR2, MYT1	chr20	Novel	Novel, novel	4.60E-05	0.017204
rs7005140	intergenic	SLC30A8, MED30	chr8	Fasting glucose (22885924)	Confirmed, novel	1.90E-05	0.0176
rs2334255	UTR3	GIPR	chr19	Novel	BMI (20935630)	0.00034	0.017642
rs4712540	intronic	CDKAL1	chr6	T2D (26551672)	Confirmed	8.00E-06	0.017913
rs2466292	downstream	SLC30A8	chr8	T2D (26551672)	Confirmed	1.70E-05	0.018263
rs1783598	intronic	FCHSD2	chr11	log(Proinsulin) (21873549)	Novel	0.00052	0.019356
rs2190324	intergenic	ARL4A, ETV1	chr7	Novel	Novel, novel	9.20E-06	0.021039
rs11548393	UTR3	SPRED2	chr2	Novel	Novel	1.10E-05	0.023013
rs17584208	intergenic	PSRC1, MYBPHL	chr1	LDL (20686565)	LDL GLGC(20686565), novel	0.0016	0.02976
rs9349534	intergenic	DEFB112, TFAP2D	chr6	Novel	Novel, novel	4.50E-05	0.03216
rs7748736	intronic	SSR1	chr6	Novel	Confirmed	3.20E-05	0.035146

rs1473	intronic	PUM1	chr1	Novel	Novel	0.00092	0.03542
rs10898868	intronic	ARAP1	chr11	log(Proinsulin) (21873549)	Confirmed	0.00044	0.03608
rs11639314	intronic	PEAK1	chr15	LD	Novel	3.90E-05	0.036597
rs1996023	intergenic	GNPDA2, GABRG1	chr4	BMI (25673413)	BMI (25673413), novel	0.025	0.0375
rs10743609	intergenic	KLHL42, PTHLH	chr12	Novel	Novel, novel	1.60E-05	0.038647
rs3898882	intergenic	BCL2L11, MIR4435-1	chr2	LD	Novel, novel	0.00011	0.038885
rs9268402	intergenic	C6orf10, HCG23	chr6	Novel	Novel, novel	0.00013	0.04056
rs7186510	intronic	CMIP	chr16	Novel	Novel	3.00E-04	0.044373
rs825461	intronic	ZNF664, FAM101A	chr12	HDL (24097068)	Waist-to-hip ratio adjusted for BMI (25673412)	0.0013	0.04472
rs7586601	intergenic	GTF3C2, EIF2B4	chr2	Triglycerides (20686565)	Novel, novel	0.00024	0.0449
rs192710	intergenic	TSPAN15, NEUROG3	chr10	Novel	Novel, novel	5.80E-05	0.044956
rs16945088	intronic	FTO	chr16	BMI (25673413)	Confirmed	0.0072	0.045
rs9540493	intergenic	LOC102723968, LINC01052	chr13	BMI (25673413)	Novel, novel	0.0057	0.0456
rs11247980	intergenic	CTBP1-AS2, MAEA	chr4	Novel	Confirmed, confirmed	6.60E-05	0.047601
rs4238585	intergenic	GPR139, GP2	chr16	BMI (25673413)	Novel, BMI (22344219)	0.0069	0.0483
rs12454712	intronic	BCL2	chr18	T2D (22325160)	Confirmed	0.0034	0.048571

rs1147322	UTR5	ZBTB6	chr9	Novel	Novel	0.00039	0.048927
-----------	------	-------	------	-------	-------	---------	----------

Notes:

SNP type means whether SNPs identified in our study compared to the original T2D GWAS and previous studies are Novel or Confirmed or associated with T2D-related traits (trait (PMID)) or in high LD with T2D-associated loci.

Gene type means whether genes identified in our study compared to the original T2D GWAS and previous studies are Novel or Confirmed.

P.valueB is the p value of T2D, B is T2D.

cFDR.BcA is the cFDR value of T2D conditioned on BMI, A is BMI.

Table S5 SNPs in high LD ($R^2 > 0.6$) with T2D-associated loci

SNP	R2	Proxy SNP	PMID	Trait
rs2283228	1	rs2237892	DIAGRAM (24509480)	T2D
rs6991067	0.621	rs13257021	DIAGRAM (24509480)	T2D
rs17791633	0.785	rs13292136	Voight BF (20581827)	T2D
rs7965349	0.817	rs7957197	Voight BF (20581827)	T2D
rs7812465	0.688	rs10099941	DIAGRAM (24509480)	T2D
rs11659412	0.851	rs8090011	Perry JR (22693455)	T2D
rs17013152	1	rs17012998	Cho YS (22158537)	T2D
rs11639314	0.606	rs12911371	DIAGRAM (24509480)	T2D
rs3898882	0.813	rs7565457	GIANT (25673413)	Height

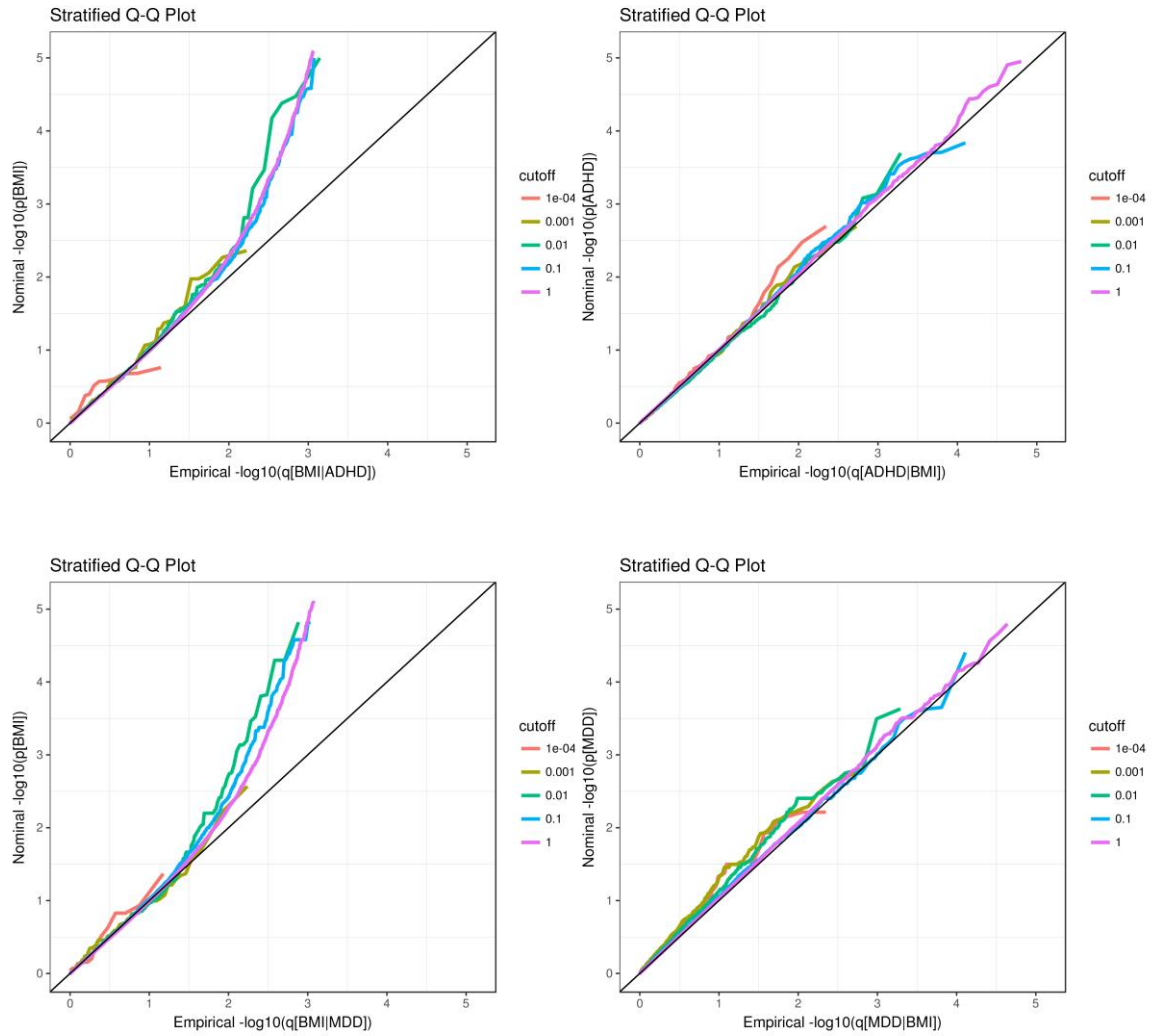


Figure S1. Stratified QQ plots. Upper Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) BMI as a function of significance of the association with ADHD, and in (right) ADHD as a function of significance of the association with BMI. Lower Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) BMI as a function of significance of the association with MDD, and in (right) MDD as a function of significance of the association with BMI.

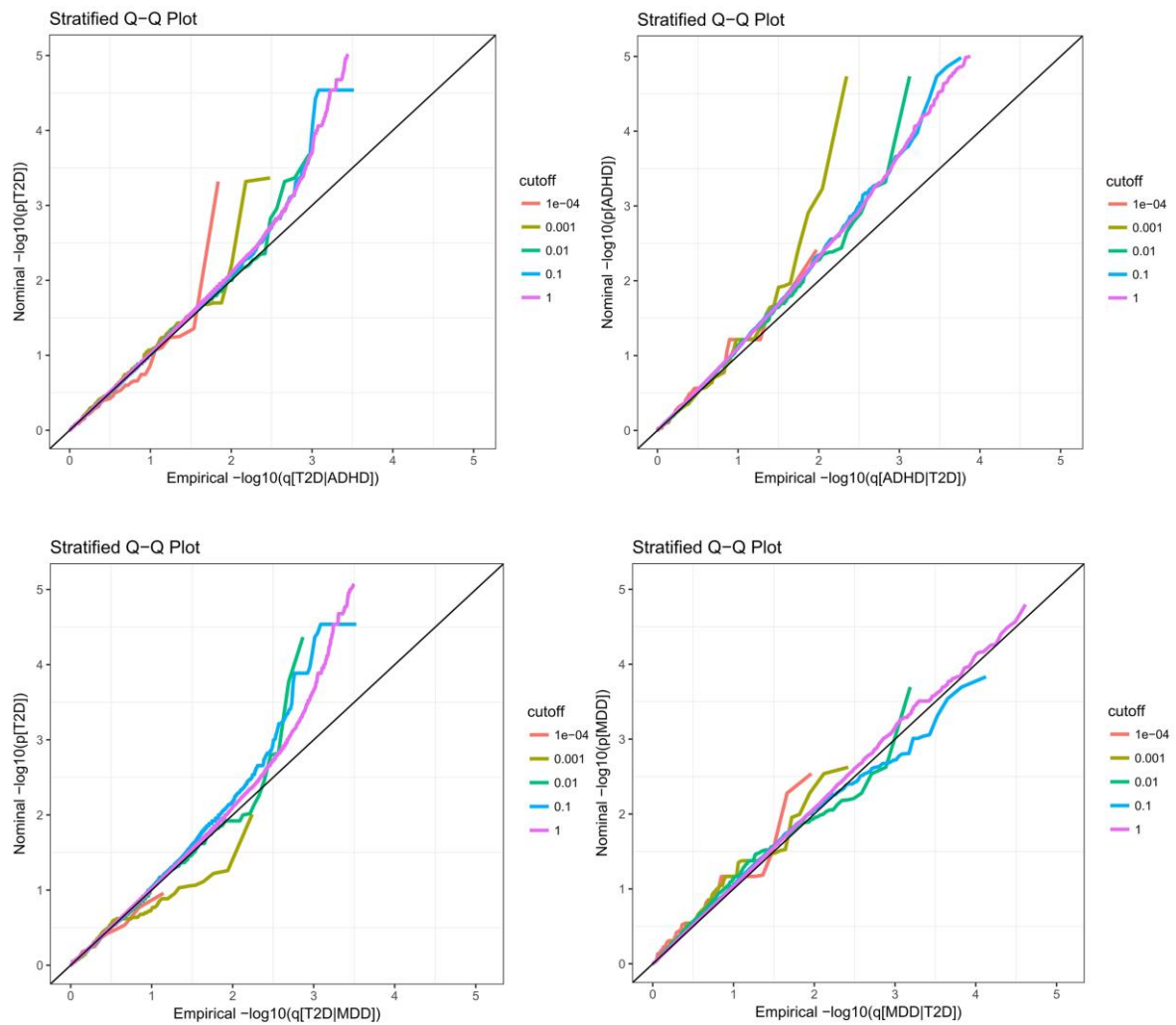


Figure S2. Stratified QQ plots. Upper Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) T2D as a function of significance of the association with ADHD, and in (right) ADHD as a function of significance of the association with T2D. Lower Panel: Stratified QQ plots of nominal versus empirical $-\log_{10}$ p-values in (left) T2D as a function of significance of the association with MDD, and in (right) MDD as a function of significance of the association with T2D.

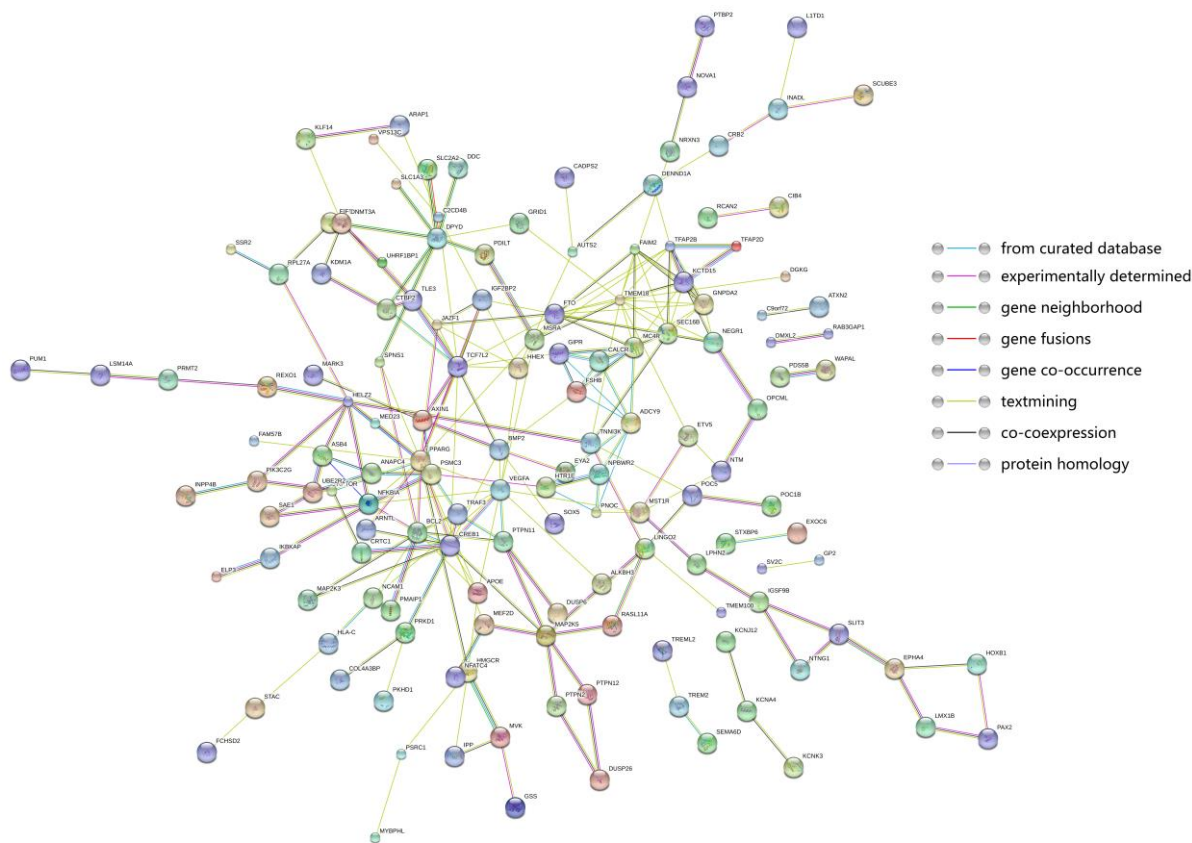


Figure S3. Protein-protein interactions between BMI-associated genes.

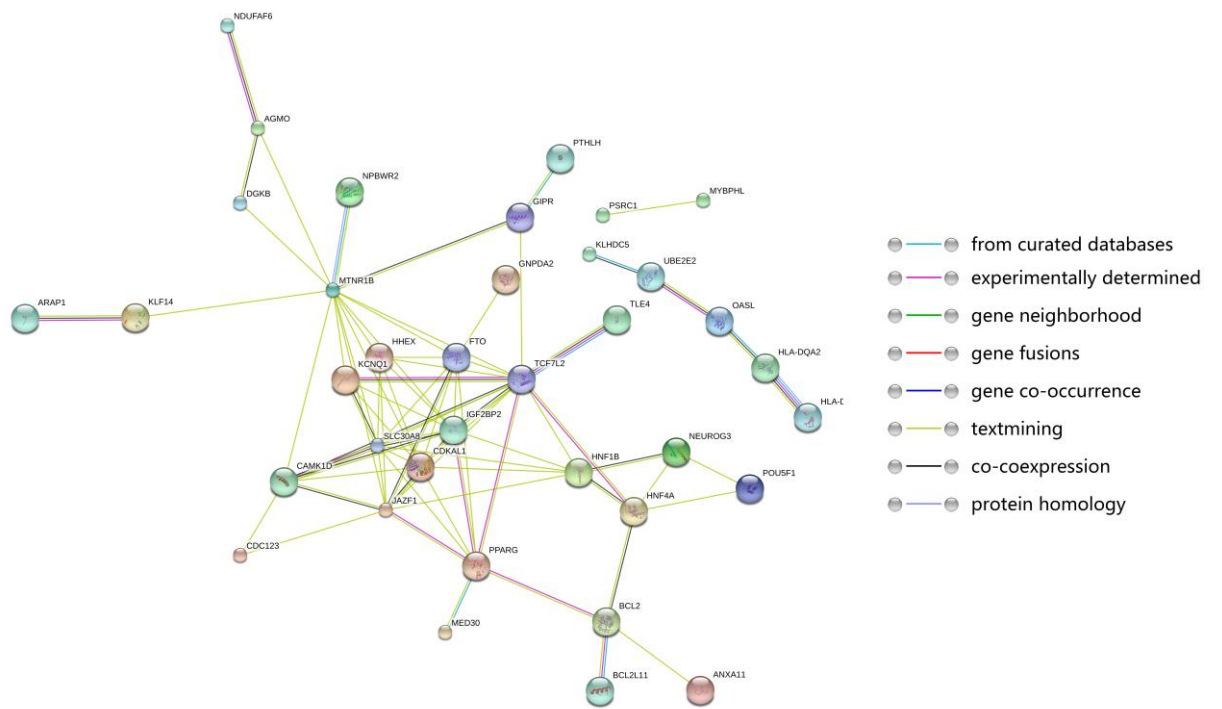


Figure S4. Protein-protein interactions between T2D-associated genes.