Supplementary Materials

Table S1 Basic characteristics of the enrolled subjects based on sex.

	Male			Female		
	Control(N=1280)	Case(N=3714)	P	Control(N=1519)	Case(N=621)	P
Age (years)	52±7	44±12	<0.001	52±7	53±12	0.066
Height (m)	1.69±0.06	1.72±0.06	<0.001	1.59±0.06	1.60±0.05	<0.001
Weight (Kg)	71.4±10.5	83.1±13.0	<0.001	60.2±9.5	71.8±15.7	<0.001
BMI (Kg/m^2)	24.9±3.2	27.8±3.7	<0.001	24.0±3.5	28.0±5.5	<0.001
WC (cm)	87.5±9.4	99.8±9.8	<0.001	80.2±9.7	96.7±13.6	<0.001
HC, (cm)	95.2±7.0	103.2±7.4	<0.001	93.8±7.6	103.6±11.3	<0.001
WHR	0.92±0.06	0.97±0.05	<0.001	0.85±0.06	0.93±0.07	<0.001
FBG (mmol/L)	5.75±1.78	5.65±1.24	<0.001	5.38±1.30	5.94±1.60	<0.001
FIN (uU/ml)	10.42±7.26	15.15±12.83	<0.001	10.54±6.01	15.42±11.57	<0.001
TC (mmol/L)	5.17±1.03	4.88±0.98	0.01	5.41±1.57	4.98±1.11	<0.001
TG (mmol/L)	2.11±2.00	2.27±1.99	<0.001	1.57±1.23	1.97±1.64	<0.001
HDL-C (mmol/L)	1.26±0.32	1.02±0.22	<0.001	1.49±0.38	1.18±0.28	<0.001
LDL-C (mmol/L)	3.01±1.03	3.01±0.81	0.072	2.93±1.00	3.03±0.91	0.032
AHI	-	50.2±21.2	-		43.7±23.0	-
ODI	-	49.1±25.1	-		44.8±26.4	-
MAI	-	32.9±25.5	-		25.7±23.8	-

The data are presented as means and standard deviation and categorical data as the number (percentage). Differences in the baseline characteristics between the two groups were examined using t-test.

BMI, body mass index; WC, waist circumference; HC, hip circumference; WHR, waist/hip ratio; FBG: fasting blood glucose; FIN: fasting serum insulin; TC, total cholesterol; TG, triglyceride; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein; cholesterol; AHI, apnoea–hypopnea index; ODI, oxygen desaturation index; MAI, micro-arousal index.

Table S2 the linear associations between BMI SNPs with sleep apnea related characteristics of OSA

SNP	BMI		AHI		ODI		MAI		TC		TG		HDL		LDL		FBP		FIN	
	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P
rs574367	0.1475	0.1745	0.4604	0.4265	0.5995	0.3553	0.9625	0.131	-0.01936	0.4808	0.02115	0.6842	0.00493	0.427	-0.0344	0.1231	0.04333	0.2069	0.3247	0.2669
rs1514175	0.07403	0.4661	-0.006826	0.9899	0.2414	0.6911	-0.5206	0.3855	0.02588	0.3145	-0.0116	0.8119	0.009242	0.112	0.0173	0.408	0.0156	0.6292	0.476	0.08202
rs1555543	-0.1012	0.4509	0.6468	0.3661	0.9008	0.2634	0.07064	0.9292	0.0349	0.3047	0.0173	0.7881	0.008853	0.2491	0.005335	0.8468	-0.02248	0.5968	-0.8291	0.02202
rs2568958	-0.1431	0.3821	-0.2657	0.761	-0.04256	0.9654	-1.265	0.1874	-0.06726	0.1035	-0.1338	0.087	0.008023	0.39	-0.02759	0.4109	-0.04257	0.4115	-0.2606	0.5539
rs713586	0.009568	0.9112	0.02018	0.9648	-0.0981	0.848	0.9834	0.04932	-0.007295	0.7367	-0.05618	0.1719	0.006174	0.2076	0.007954	0.6517	-0.01021	0.7071	-0.2476	0.2831
rs6548238	-0.4883	0.001836	-1.948	0.01974	-1.771	0.05916	-1.472	0.1119	-0.03577	0.3655	0.01236	0.8688	-0.006225	0.4859	-0.01637	0.6102	-0.08392	0.08983	-0.9682	0.02081
rs2535633	0.08588	0.3288	-0.5235	0.2643	-0.5902	0.2614	-0.3359	0.5188	0.02496	0.2613	-0.03691	0.3791	-0.002885	0.5657	0.01836	0.3098	0.00297	0.9151	0.3668	0.121
rs7647305	-0.1198	0.5424	-0.2928	0.7812	-1.059	0.3688	2.223	0.05529	-0.01133	0.8207	-0.09048	0.334	0.012	0.2892	0.01225	0.7625	0.01353	0.8264	-0.7243	0.1652
rs10938397	0.163	0.07743	0.5713	0.2456	1.268	0.02173	-0.1373	0.8014	-0.04279	0.06787	-0.05923	0.1799	0.000663	0.9005	-0.01231	0.5179	-0.02707	0.3537	-0.2559	0.3046
rs261967	0.2672	0.002155	-0.364	0.4332	0.2979	0.5675	-0.6164	0.2301	-0.01683	0.4449	0.01419	0.7339	-0.01549	0.001852	-0.01047	0.5586	0.02571	0.3518	0.3546	0.1303
rs2112347	0.1753	0.04497	0.3483	0.4548	0.5006	0.3387	0.1375	0.7894	-0.0225	0.3102	0.05537	0.1871	-0.00673	0.179	-0.03423	0.05731	0.004542	0.8698	0.07963	0.7356
rs206936	-0.05067	0.5578	-0.2418	0.5999	-0.1239	0.8108	-0.01257	0.9802	0.01927	0.3786	0.005071	0.9026	0.006362	0.1979	0.008218	0.644	0.002931	0.9147	0.3999	0.08576
rs987237	0.2796	0.01711	-0.6558	0.2942	0.3941	0.5742	0.5603	0.419	0.02116	0.4767	-0.06572	0.243	-6.51E-05	0.9923	0.03737	0.1218	0.04106	0.2716	0.3776	0.2337
rs9356744	-0.1097	0.2182	0.1157	0.8074	-0.5945	0.2638	-0.5283	0.3133	-0.02718	0.2276	-0.02871	0.5008	-0.001796	0.7241	-0.01989	0.2771	0.07889	0.005017	-0.4126	0.08522
rs11142387	-0.1697	0.06829	0.3897	0.4318	0.6325	0.2545	0.2456	0.6536	0.04028	0.08771	0.02338	0.6006	0.003358	0.5285	0.01438	0.453	-0.01036	0.7256	-0.2555	0.3074
rs10968576	0.1904	0.07096	0.9214	0.1004	1.191	0.05836	0.482	0.4383	-0.0136	0.6091	0.001896	0.9701	-0.002764	0.6457	0.004165	0.8473	0.01643	0.6221	0.5256	0.06119
rs11191580	-0.1084	0.2514	0.3342	0.5072	0.2264	0.6889	1.033	0.06505	-0.04379	0.06698	-0.06465	0.1533	0.001202	0.824	-0.02019	0.2987	-0.03727	0.2125	0.119	0.641
rs6265	-0.1218	0.1518	-0.3987	0.3789	-0.7352	0.149	-0.1398	0.7813	0.02306	0.2833	0.01406	0.7297	0.007417	0.127	0.02167	0.215	-0.07994	0.002913	-0.2899	0.2039
rs2237892	0.1474	0.1212	0.3088	0.5431	0.7805	0.1693	-0.2146	0.6972	-0.02553	0.2836	0.03745	0.411	-0.00307	0.571	-0.02883	0.1341	-0.09926	0.001023	0.6052	0.01837
rs3817334	0.0675	0.4697	0.1221	0.8062	0.1336	0.8109	0.494	0.3659	0.04168	0.07715	0.04191	0.3479	-0.000651	0.9027	0.02726	0.1547	0.03699	0.21	0.2084	0.4062
rs4929949	-0.005943	0.9452	-0.7526	0.1021	-0.6849	0.1855	0.318	0.5341	0.02506	0.2516	0.02053	0.6201	0.000107	0.9828	0.01292	0.4668	0.008853	0.7458	-0.06194	0.7899
rs671	-0.06781	0.5244	0.3892	0.4929	0.6644	0.297	0.9037	0.1484	-0.0463	0.08512	-0.06339	0.2138	-0.01687	0.00537	0.005402	0.8049	-0.006154	0.8549	0.5361	0.05898
rs7138803	0.3911	4.37E-05	-0.4275	0.4024	-0.2968	0.6049	-0.6248	0.2742	0.03213	0.1857	0.09728	0.03431	-0.003669	0.5038	0.01807	0.3599	0.04778	0.1149	0.7174	0.005488
rs4771122	0.1521	0.1743	-0.07135	0.9047	-0.1577	0.8133	-0.7087	0.2826	-0.07056	0.01121	-0.09979	0.06301	-0.006772	0.2828	-0.03094	0.1792	0.00313	0.9289	0.4899	0.104
rs2241423	0.05257	0.5469	0.3491	0.4531	0.357	0.4931	-0.4924	0.3385	0.03767	0.08746	-0.02886	0.4895	0.002844	0.5682	0.01583	0.3772	0.002329	0.9327	-0.07502	0.7495
rs1558902	0.3904	0.001809	0.3573	0.5923	0.8643	0.2474	1.161	0.116	0.03108	0.3283	0.02098	0.7272	0.006536	0.3632	0.004676	0.8563	0.05484	0.1697	0.7798	0.02075
rs7498665	0.1048	0.4298	-0.04283	0.9517	0.4178	0.598	0.4246	0.5859	0.05179	0.1211	0.01154	0.8558	-0.003597	0.6353	0.03223	0.2348	0.07199	0.0864	-0.04513	0.8996
rs12597579	0.07084	0.4713	-0.6224	0.2349	-0.1343	0.8188	-0.4571	0.4272	0.01406	0.571	0.000371	0.9937	0.004461	0.4271	0.01805	0.3706	-0.05922	0.05684	-0.293	0.2682
rs17782313	0.2024	0.0532	1.086	0.05156	1.33	0.03389	1.205	0.04984	-0.0201	0.4476	-0.01686	0.7365	-0.001552	0.7954	-0.00679	0.7522	0.06897	0.03754	-0.08203	0.7711
rs29941	-0.01337	0.8968	0.537	0.3275	0.7423	0.2275	-0.1393	0.8176	-0.01754	0.5	0.03165	0.5229	-0.01008	0.08741	-0.01265	0.5494	-0.004134	0.8988	0.0823	0.7645
rs3810291	0.2656	0.006435	0.4935	0.3411	0.9219	0.112	0.8177	0.1533	0.01102	0.6525	-0.01317	0.7751	0.00563	0.3113	-0.00602	0.7618	0.00906	0.7673	0.1445	0.5818
rs11671664	-0.1185	0.1899	-0.3823	0.4266	-0.4086	0.4454	-0.4099	0.4242	0.02008	0.3745	0.07685	0.07372	-0.006901	0.1761	-0.007176	0.6949	-0.02067	0.4691	0.3335	0.1693

adjust for age sex

Table S3 the linear associations between WHR SNPs with sleep apnea related characteristics of OSA

SNP	WHR		AHI		ODI		MAI		TC		TG		HDL		LDL		FBP		FIN	
	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P	ß	P
rs984222	-0.003521	0.001431	0.01966	0.965	-0.4245	0.3882	-0.1371	0.791	-0.006987	0.7553	-0.0486	0.252	-0.000556	0.9124	0.009446	0.6043	0.002497	0.9268	0.0266	0.9015
rs4846567	0.001765	0.1372	-0.5265	0.2749	-0.4227	0.425	1.083	0.05154	0.02849	0.2374	0.1062	0.01976	-0.006386	0.2392	-0.00082	0.9666	0.01855	0.5265	-0.6104	0.007979
rs10195252	-0.000708	0.697	-0.2096	0.7764	-0.3222	0.6917	-0.3876	0.648	0.02413	0.5147	0.03565	0.611	0.006138	0.4612	-0.01416	0.6383	-0.02247	0.6179	-0.6156	0.0818
rs6905288	0.00045	0.7142	0.09934	0.8421	0.3767	0.4908	0.3568	0.531	0.009599	0.7001	-0.13	0.005804	0.0197	0.00042	0.03624	0.07384	-0.01275	0.6737	-0.07714	0.7459
rs6931262	0.000818	0.5449	0.06775	0.9017	0.07246	0.9039	-0.4281	0.4986	0.01322	0.6289	-0.01969	0.7039	-0.004498	0.4643	0.04348	0.05071	0.01268	0.7042	0.1492	0.5681
rs1055144	0.000853	0.4332	-0.2929	0.5073	-0.3591	0.4607	-0.3176	0.5351	0.02379	0.282	-0.03187	0.4461	0.005045	0.3108	0.03224	0.07311	-0.013	0.6288	0.5001	0.01804
rs12679556	0.00159	0.206	-0.4797	0.3479	-0.3623	0.5184	0.03083	0.9587	0.01017	0.69	-0.04618	0.3396	0.004386	0.4448	0.006259	0.7624	-0.06677	0.03104	-0.06677	0.785
rs10991437	0.001122	0.3169	0.3215	0.48	0.5525	0.2696	0.8302	0.1152	0.02046	0.3687	0.05674	0.1876	-0.001031	0.8406	0.003643	0.8441	-0.000263	0.9924	0.2	0.3586
rs7917772	0.000605	0.572	-0.6906	0.1116	-0.4332	0.3638	-0.05732	0.9089	0.03003	0.1674	-0.004144	0.9197	0.000325	0.9471	0.01675	0.3435	0.02581	0.3243	0.02831	0.8913
rs2925979	0.000749	0.4929	-0.3648	0.4102	-0.1658	0.7336	0.1684	0.7435	-0.0222	0.3142	0.02494	0.551	-0.005891	0.2372	-0.02424	0.1761	-0.03927	0.1439	-0.4251	0.04466
rs224333	-0.001426	0.246	-0.1467	0.7684	-0.293	0.5916	0.8694	0.1299	-0.01627	0.5121	0.0522	0.269	-0.009057	0.1052	-0.01875	0.3523	0.04017	0.1808	-0.4745	0.04677

adjust for age sex BMI

Table S4 the correlations between GRS with clinical characteristics of all subjects

	BMI GRS		WHR GRS	
	ß*	P*	ß#	P#
BMI	0.055	2.7×10^{-5}	-	-
WHR	-	-	0.017	1.96×10^{-5}
FBG	0.006	0.189	0.013	0.089
FIN	0.071	0.045	0.1	0.071
TC	0.003	0.402	0.001	0.859
TG	-0.004	0.46	0.026	0.011
HDL-C	0.001	0.4	-0.006	0.000217
LDL-C	-0.001	0.679	0.002	0.675

* adjust for age sex

adjust for age sex BMI

Table S5 The MR-egger result of MR

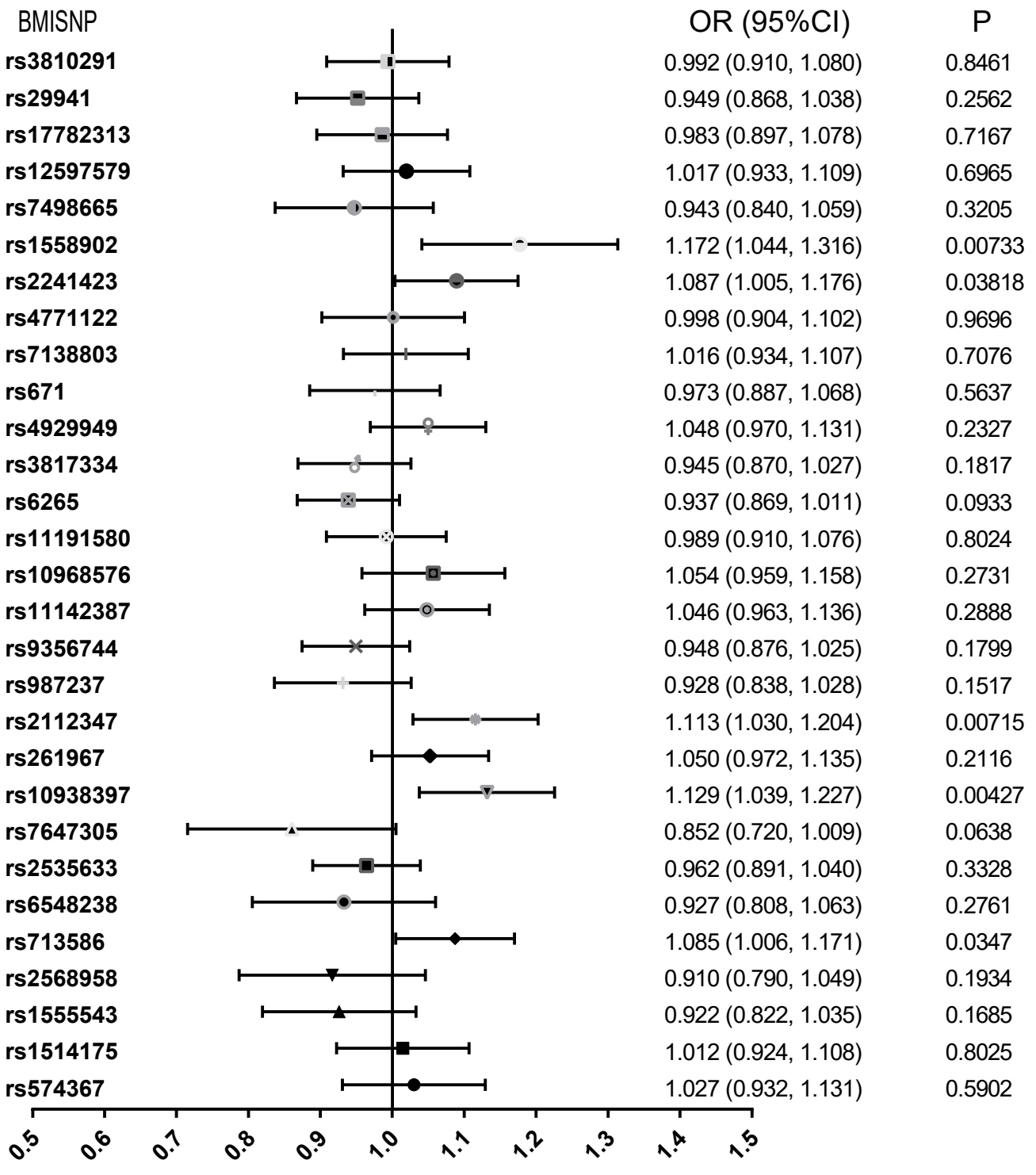
Method	Estimate	Std Error	L95%	U95%	P-value
BMI SNPs and OSA					
Simple median	0.214	0.091	0.035	0.393	0.019
IVW	0.198	0.055	0.091	0.305	<0.001
MR-Egger	0.195	0.096	0.007	0.383	0.042
intercept	0.001	0.018	-0.034	0.036	0.965
BMI SNPs and AHI					
Simple median	0.915	1.043	-1.130	2.960	0.380
IVW	0.656	0.561	-0.443	1.755	0.242
MR-Egger	0.847	0.943	-1.001	2.695	0.369
intercept	-0.043	0.169	-0.374	0.289	0.801
BMI SNPs and ODI					
Simple median	2.214	1.171	-0.081	4.508	0.059
IVW	1.931	0.629	0.698	3.163	0.002
MR-Egger	2.000	1.069	-0.095	4.096	0.061
intercept	-0.016	0.192	-0.0391	0.360	0.935
BMI SNPs and MAI					
Simple median	0.784	1.271	-1.707	3.275	0.537
IVW	0.661	0.720	-0.750	2.072	0.358
MR-Egger	1.291	1.223	-1.107	3.689	0.291
intercept	-0.140	0.219	0.569	0.288	0.522
WHR SNPs and AHI					
Simple median	-5.584	164.572	-328.138	316.971	0.973
IVW	-79.957	94.609	-265.388	105.474	0.398
MR-Egger	38.850	167.771	-289.974	367.675	0.817
intercept	-0.223	0.260	-0.731	0.286	0.391
WHR SNPs and ODI					
Simple median	88.549	181.826	-267.823	444.922	0.626
IVW	39.684	103.953	-164.061	243.429	0.703
MR-Egger	119.733	184.363	-241.611	481.078	0.516
intercept	-0.150	0.285	-0.709	0.409	0.599
WHR SNPs and MAI					
Simple median	38.938	206.346	-365.493	443.368	0.850
IVW	83.952	109.385	-130.439	298.342	0.443
MR-Egger	61.513	200.059	-330.594	453.621	0.758
intercept	0.042	0.309	-0.564	0.648	0.892

CI, confidence interval; IVW, inverse-variance weighted; L95%, lower bound of the 95% CI; U95%, upper bound of the 95% CI; SNP, single-nucleotide polymorphism.

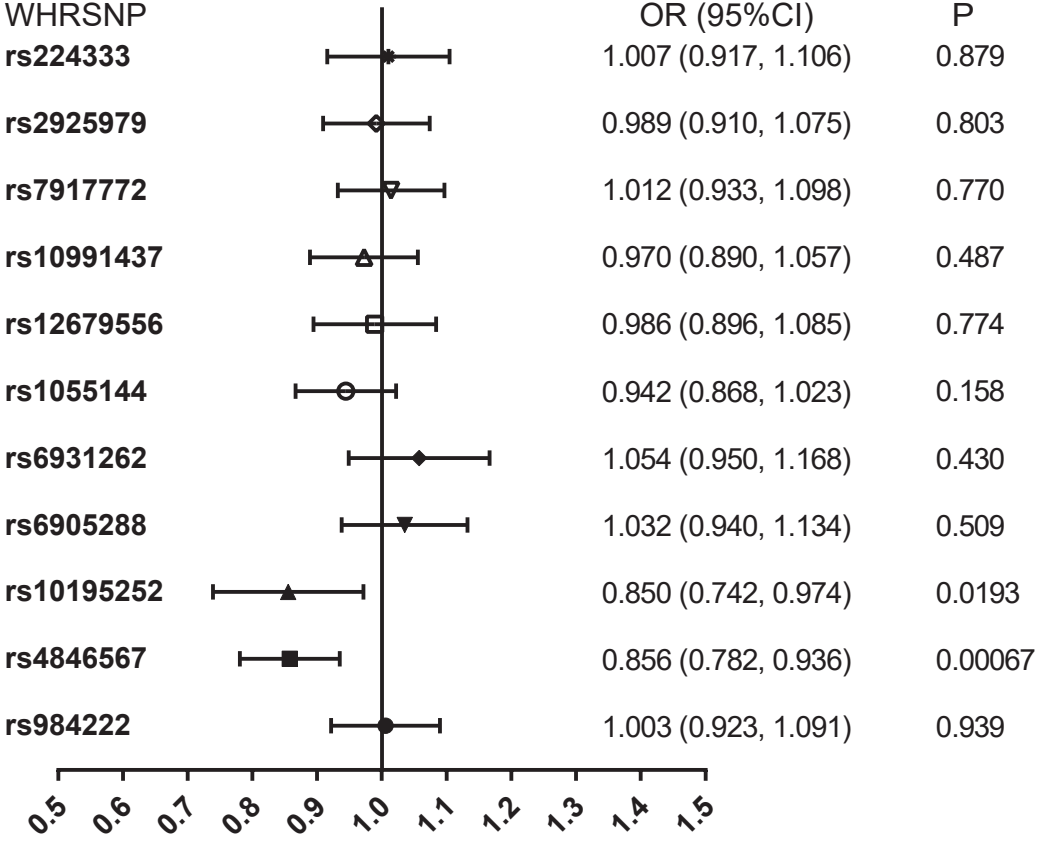
Table S6 The power calculations of MR

		Power	NCP	F-statistic
Total	BMI GRS and OSA	1.00	27.39	554.50
	BMI GRS and AHI	1.00	67.76	229.23
	BMI GRS and ODI	1.00	127.68	229.23
	BMI GRS and MAI	1.00	55.88	229.23
	WHR GRS and OSA	1.00	453.73	6201.58
	WHR GRS and AHI	-	-	-
	WHR GRS and ODI	-	-	-
	WHR GRS and MAI	-	-	-
Male	BMI GRS and OSA	1.00	32.88	416.21
	BMI GRS and AHI	1.00	48.43	206.51
	BMI GRS and ODI	1.00	105.52	206.51
	BMI GRS and MAI	1.00	47.00	206.51
	WHR GRS and OSA	0.87	9.64	3206.13
	WHR GRS and AHI	-	-	-
	WHR GRS and ODI	-	-	-
	WHR GRS and MAI	-	-	-
Female	BMI GRS and OSA	-	-	-
	BMI GRS and AHI	1.00	196.63	329.34
	BMI GRS and ODI	1.00	237.56	329.34
	BMI GRS and MAI	1.00	109.11	329.34
	WHR GRS and OSA	1.00	913.24	3161.37
	WHR GRS and AHI	-	-	-
	WHR GRS and ODI	-	-	-
	WHR GRS and MAI	-	-	-

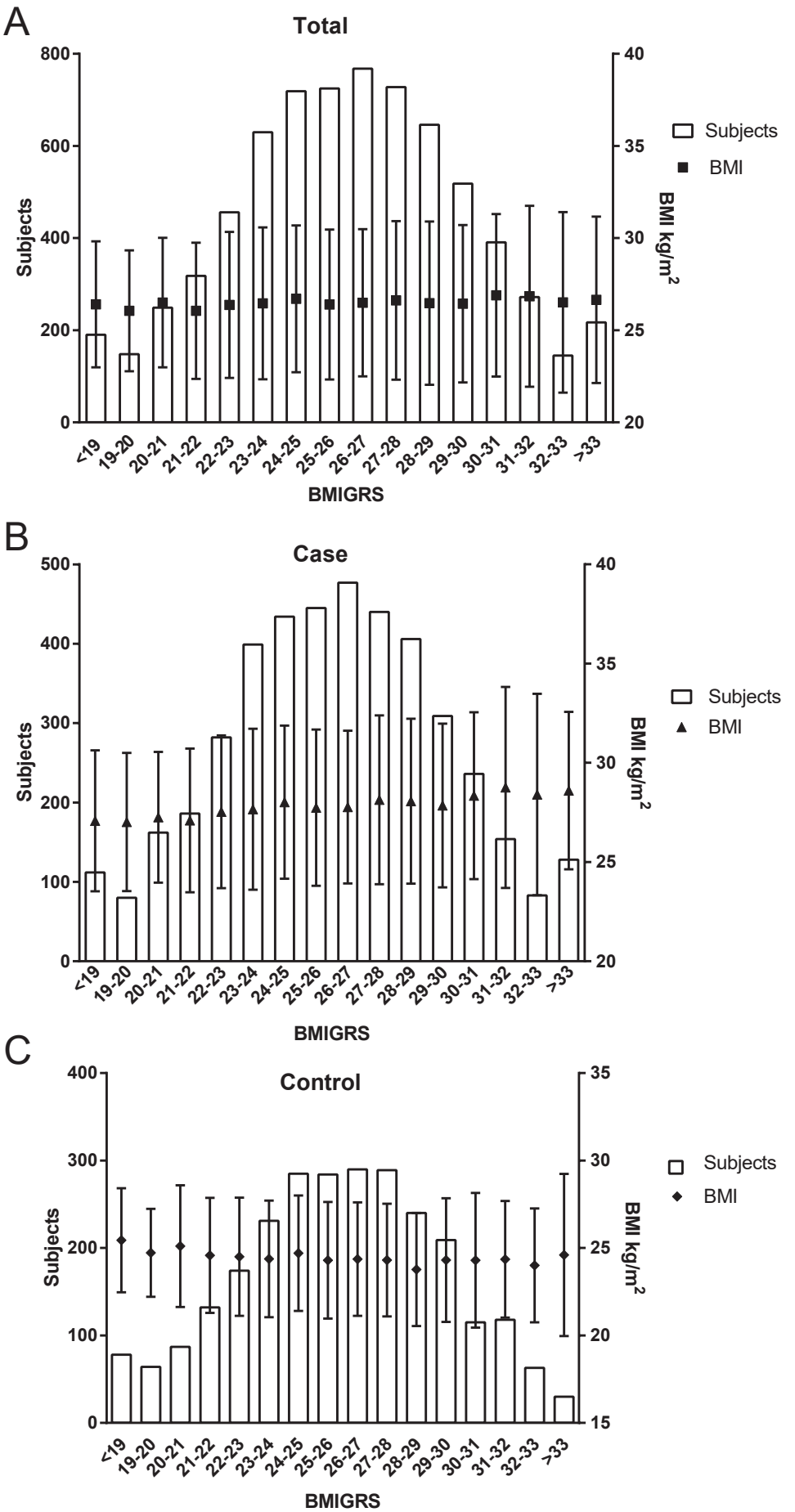
Power calculations for two-stage least squares Mendelian Randomization studies using a genetic instrument. NCP, Non-Centrality-Parameter; F-statistic: The strength of the instrument.



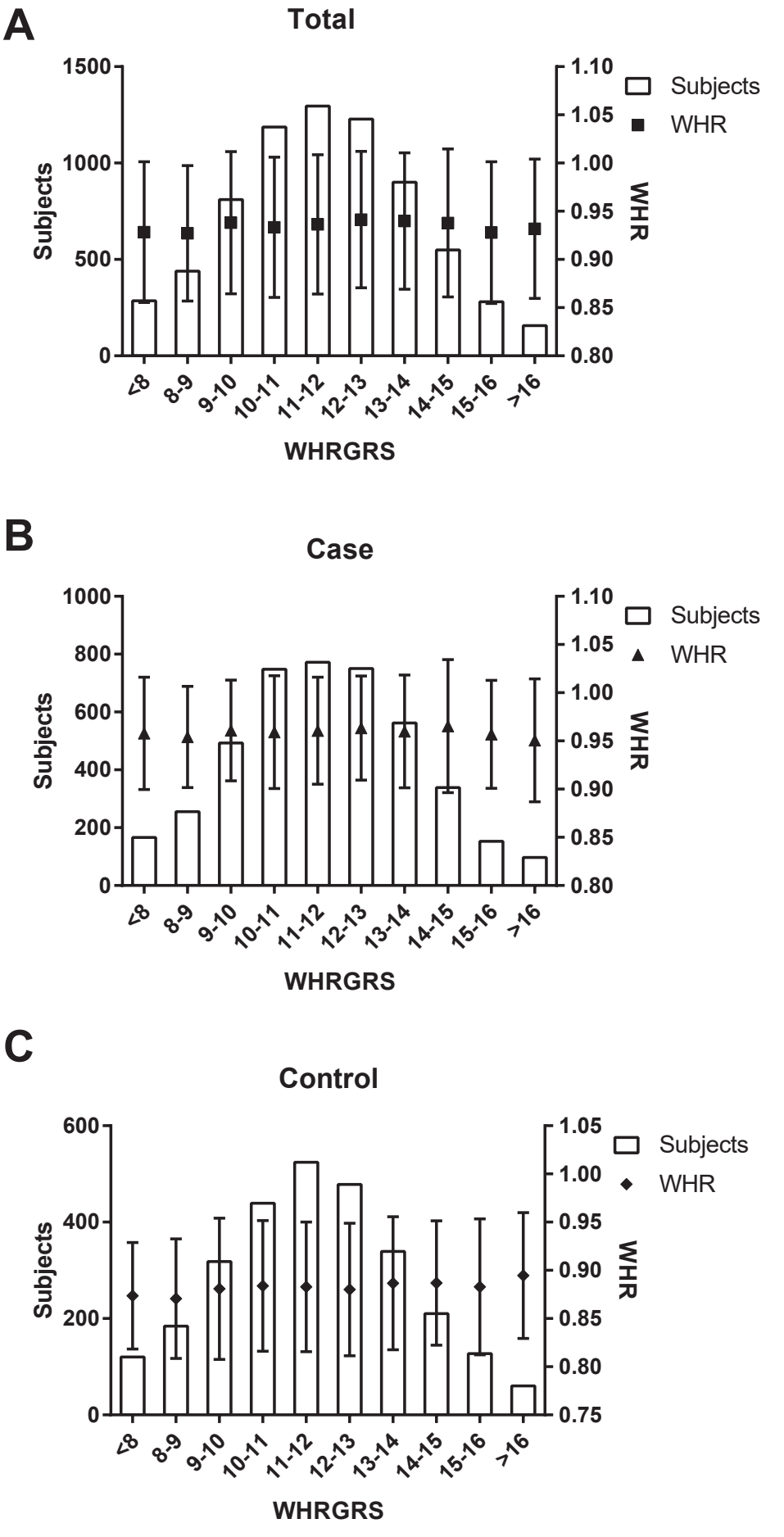
Figures S1 The associations of the BMI-associated SNPs with OSA risk



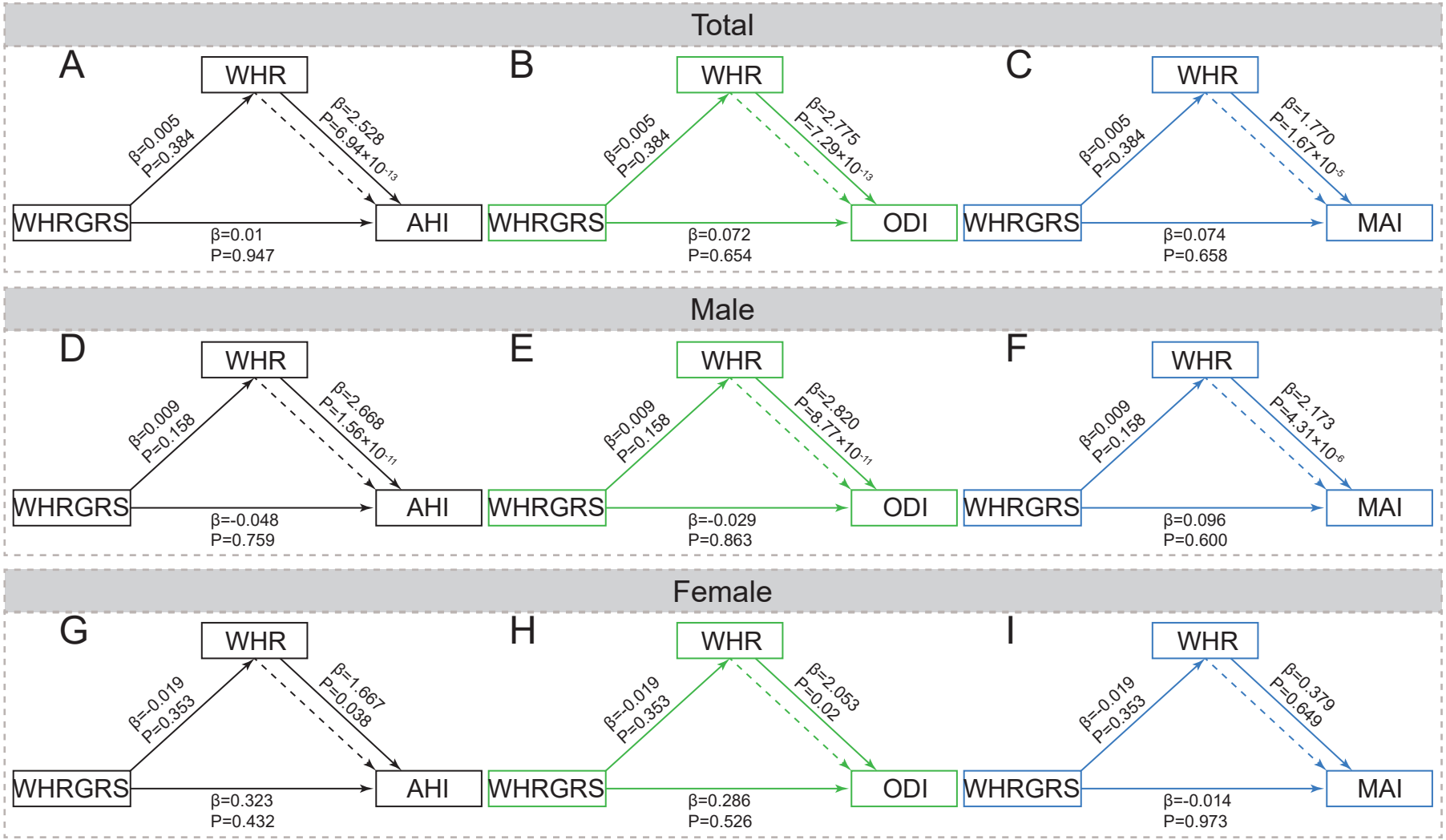
Figures S2 The associations of the WHR-associated SNPs with OSA risk



Figures S3 The distributions of BMI and BMI-GRS; Figures S3A The BMI-GRS distribution and its association with BMI in total population; Figures S3B The BMI-GRS distribution and its association with BMI in case group; Figures S3C The BMI-GRS distribution and its association with BMI in control group.



Figures S4 The distributions of WHR and WHR-GRS; Figures S4A The WHR-GRS distribution and its association with WHR in total population; Figures S4B The WHR-GRS distribution and its association with WHR in the case group; Figures S4C The WHR-GRS distribution and its association with WHR in the control group.



Figures S5 Mendelian randomization analysis for the association of WHR GRS and OSA quantitative traits. Figure S5A WHR GRS and AHI for total population; Figure S5B WHR GRS and ODI for total population; Figure S5C WHR GRS and MAI for total population; Figure S5D WHR GRS and AHI for men; Figure S5E WHR GRS and ODI for men; Figure S5F WHR GRS and MAI for men; Figure S5G WHR GRS and AHI for women; Figure S5H WHR GRS and ODI for women; Figure S5I WHR GRS and MAI for women.