**Supplementary materials**



Figure S1. Forest plots of MR analysis. (A) Blond hair group on endometriosis. (B) Red hair group on endometriosis. (C) Light brown hair group on endometriosis. (D) Dark brown hair on endometriosis. (E) Black hair on endometriosis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Traits | Search Entries in the IEU OpenGWAS project | Data sources (ID) | Sample size | Ncases  | Ncontrols | Ancestry |
| Exposure |  |  |  |  |  |  |
| blonde hair | Hair color (natural, before greying): blond | 1747\_1 | 360,270 | 41,178 | 319,092 | European |
| red hair | Hair color (natural, before greying): Red | 1747\_2 | 360,270 | 16,615 | 343,655 | European |
| light brown hair | Hair color (natural, before greying): light brown | 1747\_3 | 360,270 | 147,560 | 212,710 | European |
| dark brown hair  | Hair color (natural, before greying): dark brown | 1747\_4 | 360,270 | 134,627 | 225,643 | European |
| Black | Hair color (natural, before greying): black | 1747\_5 | 360,270 | 15,809 | 344,461 | European |
| Outcome |  |  |  |  |  |  |
| Skin pigmentation | Skin pigmentation | ebi-a-GCST90029033 | 548,203 | - | - | European |

Table S3. GWAS Data for natural hair color and Skin pigmentation in Europe ieu open gwas project.

|  |  |  |
| --- | --- | --- |
| Exposure | Test of heterogeneity | Test of pleiotropy |
|  | MR Inverse-Variance Weighted (MR IVW) | MR Egger regression (MR Egger) | MR Egger regression (MR Egger) |
|  | Cochrane Q | *P* | Cochrane Q | *P* | Egger intercept | *P* |
| blonde hair | 27,600.97 | 0 | 25,767.21 | 0 | -0.0047 | 0.0019 |
| red hair | 25,947.38 | 0 | 25,946.57 | 0 | 0.0002 | 0.9669 |
| Lightbrown hair | 71.7383 | 0 | 71.7287 | 0 | 0.0001 | 0.9582 |
| Darkbrown hair | 16,060.72 | 0 | 14,094.05 | 0 | 0.0047 | 0.00004 |
| black hair | 19,036.83 | 0 | 16,856.69 | 0 | 0.0088 | 0.0162 |

Table S4. Sensitivity analysis of natural hair

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Exposure*** | ***Outcome*** | ***Method*** | ***Nsnp*** | ***Pval*** | ***OR(95%CI)*** |
| Blonde | Skin pigmentation | Inverse variance weighted | 142 | 3E-39 | 2.6788(2.3117~3.1041） |
|  |  | MR Egger | 142 | 7E-24 | 3.2790(2.7110~3.9659） |
|  |  | Weighted median | 142 | 2E-188 | 1.7335(1.6708~1.7985） |
|  |  | Simple mode | 142 | 1E-21 | 1.5494(1.4366~1.6710） |
|  |  | Penalised weighted median | 142 | 3E-104 | 1.6023(1.5355~1.6721） |
|  |  | Simple mode | 142 | 1E-22 | 1.5494(1.4406~1.6664） |
| Red | Skin pigmentation | Inverse variance weighted | 57 | 0.0002549 | 2.8565(1.6276~5.0132） |
|  |  | MR Egger | 57 | 0.0036757 | 2.8346(1.4462~5.5561） |
|  |  | Weighted median | 57 | 1.59E-66 | 1.9587(1.8145~2.1143） |
|  |  | Simple mode | 57 | 0.1130209 | 1.3446(0.9377~1.9282） |
|  |  | Penalised weighted median | 57 | 1.13E-65 | 1.9582(1.8132~2.1149） |
|  |  | Simple mode | 57 | 0.1105807 | 1.3446(0.9400~1.9234） |
| Light brown | Skin pigmentation | Inverse variance weighted | 122 | 0.0078 | 0.9010(0.8344~0.9729） |
|  |  | MR Egger | 122 | 0.5148 | 0.8931(0.6393~1.2477） |
|  |  | Weighted median | 122 | 0.0045 | 0.9031(0.8417~0.9689） |
|  |  | Simple mode | 122 | 0.2898 | 0.9263(0.8065~1.0638） |
|  |  | Penalised weighted median | 122 | 0.0807 | 0.9106(0.8238~1.0066） |
| Dark brown | Skin pigmentation | Inverse variance weighted | 130 | 1.33E-87 | 0.5256(0.4932~0.5601） |
|  |  | MR Egger | 130 | 1.03E-40 | 0.4809(0.4472~0.5171） |
|  |  | Weighted median | 130 | 0 | 0.5205(0.5117~0.5294） |
|  |  | Simple mode | 130 | 2.68E-23 | 0.7524(0.7188~0.7875） |
|  |  | Penalised weighted median | 130 | 0 | 0.5179(0.5118~0.5240） |
|  |  | Simple mode | 130 | 2.06E-24 | 0.7524(0.7200~0.7862） |
| Black | Skin pigmentation | Inverse variance weighted | 50 | 7.87E-26 | 0.0751(0.0464~0.1217） |
|  |  | MR Egger | 50 | 2.87E-13 | 0.0451(0.0245~0.0830） |
|  |  | Weighted median | 50 | 4.29E-57 | 0.2325(0.1943~0.2782） |
|  |  | Simple mode | 50 | 1.41E-15 | 0.3613(0.3039~0.4295） |
|  |  | Penalised weighted median | 50 | 1.98E-56 | 0.2494(0.2100~0.2961） |
|  |  | Simple mode | 50 | 3.49E-15 | 0.3613(0.3026~0.4314） |

Table S5. Causal estimates linking genetic hair color predictions to skin pigmentation risk.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Method | beta | lci95 | uci95 | or | or\_lci95 | or\_uci95 | pval |
| BWMR | -0.1692  | -0.3244 | -0.0141 | 0.8443 | 0.7230 | 0.9860 | 0.0325 |

Table S6. The results of Bayesian Mendelian randomization analysis between hair color and endometriosis.