Supplementary material

Supplementary Table 1. Causal associations of plasma Animo acids with total testosterone.

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| --- | --- | --- | --- | --- | --- |
| Exposures | Number of SNPs | β | LCI | UCI | *p* value |
| Alanine | 104 | −0.0096 | −0.0206 | 0.0014 | 0.0867 |
| Arginine | 84 | −0.0030 | −0.0150 | 0.0089 | 0.6178 |
| Asparagine | 104 | 0.0097 | −0.0096 | 0.0289 | 0.3249 |
| Aspartate | 115 | −0.0118 | −0.0272 | 0.0036 | 0.1322 |
| Cysteine | 105 | 0.0053 | −0.0050 | 0.0155 | 0.3152 |
| Glutamate | 106 | −0.0057 | −0.0153 | 0.0039 | 0.2462 |
| Glutamine | 104 | −0.0017 | −0.0130 | 0.0096 | 0.7653 |
| Glycine | 89 | 0.0021 | −0.0069 | 0.0111 | 0.6459 |
| Histidine | 85 | 0.0127 | −0.0099 | 0.0353 | 0.2695 |
| Isoleucine | 92 | −0.0073 | −0.0185 | 0.0039 | 0.2029 |
| Leucine | 107 | −0.0056 | −0.0179 | 0.0066 | 0.3672 |
| Lysine | 104 | 0.0017 | −0.0079 | 0.0113 | 0.7306 |
| Methionine | 109 | −0.0016 | −0.0112 | 0.0079 | 0.7363 |
| Phenylalanine | 101 | −0.0008 | −0.0118 | 0.0102 | 0.8850 |
| Proline | 104 | 0.0032 | −0.0057 | 0.0121 | 0.4794 |
| Serine | 109 | 0.0108 | −0.0068 | 0.0285 | 0.2289 |
| Threonine | 92 | 0.0138 | −0.0086 | 0.0361 | 0.2285 |
| Tryptophan | 92 | 0.0021 | −0.0094 | 0.0135 | 0.7227 |
| Tyrosine | 100 | 0.0125 | −0.0022 | 0.0272 | 0.0948 |
| Valine | 81 | −0.0086 | −0.0206 | 0.0033 | 0.1563 |

The causal estimates were combined by the inverse variance weighting method. SNPs: Single nucleotide polymorphisms; LCI: lower confidence interval; UCI: upper confidence interval.

Supplementary Table 2. Causal associations of plasma Animo acids with SHBG.

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| --- | --- | --- | --- | --- | --- |
| Exposures | Number of SNPs | β | LCI | UCI | *p* value |
| Alanine | 104 | −0.0068 | −0.0179 | 0.0042 | 0.2264 |
| Arginine | 84 | −0.0012 | −0.0131 | 0.0107 | 0.8465 |
| Asparagine | 104 | 0.0183 | −0.0086 | 0.0451 | 0.1829 |
| Aspartate | 115 | −0.003 | −0.0204 | 0.0144 | 0.7366 |
| Cysteine | 105 | −0.0024 | −0.0125 | 0.0078 | 0.6471 |
| Glutamate | 106 | −0.0048 | −0.0161 | 0.0065 | 0.4083 |
| Glutamine | 104 | −0.0015 | −0.0131 | 0.0101 | 0.7971 |
| Glycine | 89 | 0.0015 | −0.0093 | 0.0123 | 0.7844 |
| Histidine | 85 | 0.0214 | −0.0103 | 0.0532 | 0.1858 |
| Isoleucine | 92 | 0.0045 | −0.0067 | 0.0158 | 0.4309 |
| Leucine | 107 | −0.0001 | −0.0109 | 0.0107 | 0.9865 |
| Lysine | 104 | 0.0044 | −0.0047 | 0.0136 | 0.3440 |
| Methionine | 109 | 0.0024 | −0.0086 | 0.0134 | 0.6649 |
| Phenylalanine | 101 | −0.0035 | −0.0139 | 0.0069 | 0.5097 |
| Proline | 104 | −0.0008 | −0.0099 | 0.0083 | 0.8618 |
| Serine | 109 | 0.0119 | −0.0124 | 0.0363 | 0.3377 |
| Threonine | 92 | 0.0224 | −0.0079 | 0.0526 | 0.1468 |
| Tryptophan | 92 | 0.0028 | −0.0082 | 0.0138 | 0.6172 |
| Tyrosine | 100 | 0.0165 | −0.0027 | 0.0356 | 0.0914 |
| Valine | 81 | −0.0060 | −0.0189 | 0.0068 | 0.3556 |

The causal estimates were combined by the inverse variance weighting method. SHBG: Sex hormone binding globulin; SNPs: Single nucleotide polymorphisms; LCI: lower confidence interval; UCI: upper confidence interval.

Supplementary Table 3. Causal associations of plasma Animo acids with bioavailable testosterone.

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| --- | --- | --- | --- | --- | --- |
| Exposures | Number of SNPs | β | LCI | UCI | *p* value |
| Alanine | 104 | −0.0065 | −0.0167 | 0.0036 | 0.2069 |
| Arginine | 84 | −0.0057 | −0.0162 | 0.0048 | 0.2886 |
| Asparagine | 104 | −0.0040 | −0.0131 | 0.0052 | 0.3948 |
| Aspartate | 115 | −0.0103 | −0.0218 | 0.0013 | 0.0814 |
| Cysteine | 105 | 0.0052 | −0.0060 | 0.0163 | 0.3622 |
| Glutamate | 106 | −0.0023 | −0.0130 | 0.0085 | 0.6764 |
| Glutamine | 104 | 0.0011 | −0.0107 | 0.0130 | 0.8539 |
| Glycine | 89 | 0.0050 | −0.0037 | 0.0136 | 0.2607 |
| Histidine | 85 | −0.0019 | −0.0132 | 0.0093 | 0.7352 |
| Isoleucine | 92 | −0.0132 | −0.0244 | -0.0020 | 0.0212 |
| Leucine | 107 | −0.0091 | −0.0207 | 0.0024 | 0.1199 |
| Lysine | 104 | 0.0022 | −0.0090 | 0.0135 | 0.6967 |
| Methionine | 109 | −0.0054 | −0.0153 | 0.0045 | 0.2850 |
| Phenylalanine | 101 | 0.0056 | −0.0046 | 0.0157 | 0.2856 |
| Proline | 104 | 0.0023 | −0.0073 | 0.0118 | 0.6403 |
| Serine | 109 | 0.0039 | −0.0058 | 0.0136 | 0.4263 |
| Threonine | 92 | −0.0065 | −0.0178 | 0.0048 | 0.2574 |
| Tryptophan | 92 | 0.0035 | −0.0079 | 0.0148 | 0.5501 |
| Tyrosine | 100 | −0.0027 | −0.0122 | 0.0068 | 0.5794 |
| Valine | 81 | −0.0047 | −0.0156 | 0.0063 | 0.4016 |

The causal estimates were combined by the inverse variance weighting method. SNPs: Single nucleotide polymorphisms; LCI: lower confidence interval; UCI: upper confidence interval.

Supplementary Table 4. Causal associations of plasma Animo acids with erectile dysfunction.

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| Exposures | Number of SNPs | β | LCI | UCI | *p* value |
| Alanine | 89 | −0.0431 | −0.1060 | 0.0198 | 0.1790 |
| Arginine | 64 | −0.0128 | −0.0870 | 0.0614 | 0.7361 |
| Asparagine | 81 | 0.0034 | −0.0623 | 0.0690 | 0.9196 |
| Aspartate | 85 | 0.0213 | −0.0443 | 0.0868 | 0.5246 |
| Cysteine | 70 | −0.0266 | −0.0919 | 0.0387 | 0.4255 |
| Glutamate | 73 | −0.0288 | −0.1031 | 0.0455 | 0.4467 |
| Glutamine | 86 | −0.0051 | −0.0729 | 0.0627 | 0.8825 |
| Glycine | 76 | −0.0214 | −0.0818 | 0.0390 | 0.4874 |
| Histidine | 66 | 0.0377 | −0.0351 | 0.1104 | 0.3106 |
| Isoleucine | 76 | −0.0613 | −0.1264 | 0.0039 | 0.0652 |
| Leucine | 85 | 0.0552 | −0.0192 | 0.1296 | 0.1459 |
| Lysine | 97 | −0.0714 | −0.1286 | -0.0141 | 0.0146 |
| Methionine | 79 | −0.0418 | −0.1087 | 0.0250 | 0.2201 |
| Phenylalanine | 82 | −0.0049 | −0.0719 | 0.0621 | 0.8859 |
| Proline | 83 | −0.0317 | −0.1037 | 0.0404 | 0.3890 |
| Serine | 90 | −0.0052 | −0.0676 | 0.0572 | 0.8696 |
| Threonine | 77 | −0.0210 | −0.0855 | 0.0434 | 0.5225 |
| Tryptophan | 85 | 0.0276 | −0.0346 | 0.0899 | 0.3845 |
| Tyrosine | 89 | −0.0271 | −0.0858 | 0.0316 | 0.3660 |
| Valine | 61 | 0.0157 | −0.0663 | 0.0976 | 0.7076 |

The causal estimates were combined by the inverse variance weighting method. SNPs: Single nucleotide polymorphisms; LCI: lower confidence interval; UCI: upper confidence interval.

Supplementary Table 5. Causal associations of plasma Animo acids with male infertility.

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| --- | --- | --- | --- | --- | --- |
| Exposures | Number of SNPs | β | LCI | UCI | *p* value |
| Alanine | 154 | 0.0376 | −0.0391 | 0.1142 | 0.3365 |
| Arginine | 131 | 0.0599 | −0.0176 | 0.1374 | 0.1297 |
| Asparagine | 140 | 0.0201 | −0.0546 | 0.0948 | 0.5979 |
| Aspartate | 153 | −0.0051 | −0.0862 | 0.0760 | 0.9021 |
| Cysteine | 148 | −0.0201 | −0.0833 | 0.0431 | 0.5329 |
| Glutamate | 140 | 0.0021 | −0.0936 | 0.0977 | 0.9661 |
| Glutamine | 154 | 0.0470 | −0.0334 | 0.1273 | 0.2520 |
| Glycine | 134 | −0.0103 | −0.0920 | 0.0714 | 0.8044 |
| Histidine | 144 | 0.0294 | −0.0456 | 0.1044 | 0.4427 |
| Isoleucine | 138 | 0.0735 | 0.0070 | 0.1400 | 0.0304 |
| Leucine | 148 | 0.0884 | 0.0227 | 0.1541 | 0.0083 |
| Lysine | 151 | 0.0307 | −0.0408 | 0.1022 | 0.4005 |
| Methionine | 172 | 0.0504 | −0.0167 | 0.1175 | 0.1410 |
| Phenylalanine | 151 | 0.0415 | −0.0357 | 0.1188 | 0.2918 |
| Proline | 145 | 0.0289 | −0.0423 | 0.1001 | 0.4263 |
| Serine | 138 | 0.0069 | −0.0749 | 0.0886 | 0.8693 |
| Threonine | 129 | 0.0651 | −0.0217 | 0.1518 | 0.1415 |
| Tryptophan | 149 | −0.0322 | −0.1041 | 0.0396 | 0.3796 |
| Tyrosine | 137 | 0.0863 | 0.0072 | 0.1654 | 0.0325 |
| Valine | 129 | 0.0668 | −0.0130 | 0.1466 | 0.1011 |

The causal estimates were combined by the inverse variance weighting method. SNPs: Single nucleotide polymorphisms; LCI: lower confidence interval; UCI: upper confidence interval.