| **Outcome**  **Supplementary Table 3. Effect size analysis in studies using protein or amino acid supplements** | **Groups and subgroups analysed** | **Studies (n)** | **Participants (n)** | **SMD** | **Lower limit** | **Upper limit** | **p value** | **I2 value** | **I2 p value** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Body composition** | All studies | 16 | 970 | 0.21 | 0.07 | 0.35 | <0.01 | 15.1 | 0.28 |
| EAA studies | 4 | 251 | 0.22 | -0.21 | 0.65 | 0.31 | 63.6 | 0.04 |
| High protein density ONS | 3 | 187 | 0.34 | -0.05 | 0.74 | 0.09 | 44.6 | 0.17 |
| Moderate protein density ONS | 2 | 171 | 0.12 | -0.18 | 0.42 | 0.44 | 0.0 | 0.56 |
| Whey protein | 2 | 112 | 0.15 | -0.22 | 0.52 | 0.43 | 0.0 | 0.66 |
| Protein-rich foods | 5 | 249 | 0.26 | 0.02 | 0.50 | 0.03 | 0.0 | 0.43 |
| Low ROB | 1 | 65 | 0.01 | -0.47 | 0.50 | 0.95 | 0.0 | 1.0 |
| Unclear ROB | 15 | 905 | 0.23 | 0.08 | 0.37 | <0.01 | 17.6 | 0.25 |
| Nourished participants in community setting | 4 | 237 | 0.13 | -0.11 | 0.38 | 0.28 | 0.0 | 0.81 |
| Undernourished participants in community setting | 6 | 396 | 0.19 | -0.09 | 0.47 | 0.18 | 41.5 | 0.13 |
| Undernourished participants in hospital setting | 2 | 82 | 0.37 | -0.40 | 1.13 | 0.35 | 55.8 | 0.13 |
| Nourished participants in long term care setting | 1 | 42 | 0.78 | 0.15 | 1.41 | 0.02 | 0.0 | 1.0 |
| Undernourished participants in long term care setting | 3 | 213 | 0.17 | -0.10 | 0.44 | 0.22 | 0.0 | 0.58 |
| Supplement with added nutrients | 11 | 700 | 0.24 | 0.09 | 0.38 | <0.01 | 0.0 | 0.56 |
| Supplement with no added nutrients | 5 | 270 | 0.17 | -0.20 | 0.55 | 0.36 | 53.2 | 0.07 |
| True placebo used | 4 | 258 | 0.23 | -0.19 | 0.65 | 0.29 | 63.3 | 0.04 |
| Without use of aerobic or rehabilitation exercise | 13 | 792 | 0.23 | 0.06 | 0.41 | 0.01 | 29.3 | 0.14 |
| With use of aerobic or rehabilitation exercise | 3 | 259 | 0.15 | -0.09 | 0.40 | 0.22 | 0.0 | 0.91 |
| **Muscle function** | All studies | 28 | 1940 | 0.27 | 0.10 | 0.44 | <0.01 | 68.4 | <0.01 |
| EAA studies | 7 | 360 | 0.82 | 0.35 | 1.28 | <0.01 | 76.9 | <0.01 |
| High protein density ONS | 5 | 295 | 0.08 | -0.15 | 0.31 | 0.50 | 0.0 | 0.62 |
| **Muscle function** | Moderate protein density ONS | 8 | 507 | 0.05 | -0.16 | 0.27 | 0.62 | 31.7 | 0.18 |
| Protein-rich foods | 3 | 166 | -0.02 | -0.34 | 0.30 | 0.89 | 0.0 | 0.43 |
| Higher protein density ONS vs. lower protein density ONS | 2 | 235 | 0.25 | -0.21 | 0.71 | 0.29 | 53.3 | 0.14 |
| Whey protein | 3 | 388 | 0.10 | -0.08 | 0.29 | 0.27 | 0.0 | 0.65 |
| Low ROB | 5 | 537 | 0.12 | -0.04 | 0.27 | 0.15 | 0.0 | 0.45 |
| Unclear ROB | 23 | 1403 | 0.31 | 0.10 | 0.52 | <0.01 | 72.0 | <0.01 |
| Nourished participants in community setting | 4 | 455 | 0.07 | -0.10 | 0.24 | 0.41 | 0.0 | 0.98 |
| Undernourished participants in community setting | 8 | 513 | 0.55 | 0.09 | 1.02 | 0.02 | 84.6 | <0.01 |
| Nourished participants in hospital setting | 1 | 28 | 0.18 | -0.57 | 0.93 | 0.63 | 0.0 | 1.0 |
| Undernourished participants in hospital setting | 7 | 583 | 0.10 | -0.14 | 0.33 | 0.43 | 47.7 | 0.08 |
| Nourished participants in long term care setting | 2 | 87 | -0.15 | -0.57 | 0.27 | 0.49 | 0.0 | 0.43 |
| Undernourished participants in long term care setting | 6 | 274 | 0.42 | 0.05 | 0.79 | 0.03 | 55.7 | 0.04 |
| Supplement with added nutrients | 22 | 1614 | 0.12 | 0.00 | 0.25 | 0.04 | 27.7 | 0.11 |
| Supplement with no added nutrients | 6 | 326 | 0.77 | 0.22 | 1.33 | <0.01 | 82.3 | <0.01 |
| True placebo used | 5 | 278 | 0.67 | -0.08 | 1.41 | 0.08 | 88.4 | <0.01 |
| Without use of aerobic or rehabilitation exercise | 18 | 1248 | 0.37 | 0.13 | 0.61 | <0.01 | 75.8 | <0.01 |
| With use of aerobic or rehabilitation exercise | 10 | 692 | 0.11 | -0.07 | 0.29 | 0.24 | 24.3 | 0.22 |
| Upper body muscle measurements | 18 | 1435 | 0.30 | 0.08 | 0.53 | <0.01 | 36.4 | 0.12 |
| Lower body muscle measurements | 10 | 505 | 0.22 | -0.00 | 0.45 | >0.05 | 75.8 | <0.01 |
| **Physical function** | All studies | 34 | 3396 | 0.24 | 0.13 | 0.36 | <0.01 | 56.8 | <0.01 |
| EAA studies | 7 | 310 | 0.82 | 0.52 | 1.12 | <0.01 | 33.6 | 0.16 |
| High protein density ONS | 8 | 602 | 0.03 | -0.17 | 0.23 | 0.78 | 35.1 | 0.14 |
| Moderate protein density ONS | 10 | 857 | 0.15 | 0.00 | 0.30 | <0.05 | 14.6 | 0.31 |
| Protein-rich foods | 3 | 929 | 0.09 | -0.06 | 0.24 | 0.22 | 5.0 | 0.35 |
| Higher protein density ONS vs. lower protein density ONS | 3 | 273 | 0.35 | -0.01 | 0.72 | 0.06 | 11.9 | 0.32 |
| Whey protein | 3 | 425 | 0.15 | -0.16 | 0.45 | 0.36 | 46.1 | 0.16 |
| Low ROB | 7 | 706 | 0.10 | -0.06 | 0.25 | 0.22 | 26.1 | 0.23 |
| Unclear ROB | 27 | 2690 | 0.30 | 0.15 | 0.45 | <0.01 | 60.7 | <0.01 |
| Nourished participants in community setting | 3 | 1180 | 0.07 | -0.04 | 0.18 | 0.21 | 0.0 | 0.37 |
| Undernourished participants in community setting | 10 | 692 | 0.50 | 0.17 | 0.82 | <0.01 | 76.5 | <0.01 |
| Nourished participants in hospital setting | 3 | 343 | 0.17 | -0.16 | 0.50 | 0.32 | 45.4 | 0.16 |
| Undernourished participants in hospital setting | 8 | 632 | 0.21 | -0.06 | 0.48 | 0.13 | 54.5 | 0.03 |
| Nourished participants in long term care setting | 4 | 172 | 0.04 | -0.27 | 0.34 | 0.82 | 0.0 | 0.92 |
| Undernourished participants in long term care setting | 6 | 377 | 0.16 | -0.07 | 0.39 | 0.18 | 20.6 | 0.27 |
| Supplement with added nutrients | 28 | 3108 | 0.13 | 0.04 | 0.22 | <0.01 | 24.0 | 0.12 |
| Supplement with no added nutrients | 6 | 288 | 0.83 | 0.49 | 1.17 | <0.01 | 44.3 | 0.11 |
| True placebo used | 5 | 269 | 0.67 | 0.05 | 1.30 | 0.04 | 81.6 | <0.01 |
| Without use of aerobic or rehabilitation exercise | 22 | 2492 | 0.31 | 0.15 | 0.46 | <0.01 | 64.9 | <0.01 |
| With use of aerobic or rehabilitation exercise | 12 | 904 | 0.12 | -0.05 | 0.30 | 0.17 | 30.5 | 0.14 |
| Usual physical activity measurements | 5 | 473 | 0.64 | 0.01 | 1.26 | <0.05 | 84.7 | <0.01 |
| Activities of daily life measurements | 8 | 558 | 0.10 | -0.13 | 0.34 | 0.39 | 47.5 | 0.06 |
| Physical performance measurements | 4 | 570 | 0.15 | -0.03 | 0.33 | 0.10 | 15.2 | 0.32 |
| Short Form Physical Component Score measurements | 5 | 395 | 0.33 | 0.12 | 0.54 | <0.01 | 5.5 | 0.38 |
| Timed up and go test measurements | 2 | 897 | 0.04 | -0.09 | 0.17 | 0.52 | 0.0 | 0.80 |
| Walk test measurements | 10 | 503 | 0.26 | 0.03 | 0.49 | 0.03 | 38.9 | 0.09 |

EAA: essential amino acid; ONS: oral nutritional supplement; ROB: risk of bias; SMD: standardised mean difference.