Supplement table 1. Descriptive characteristics of 2511 participants by gender

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 　 | Entire cohort  | Women  | Men  | *P* |
|  | (n=1242) | (n=948) | (n=294) |
| Age (years)a | 56.1(3.1) | 56.1(2.9) | 56(3.5) | 0.635 |
| Weight (kg)a | 58.9(9.5) | 56.4(8.2) | 66.9(9.3) | <0.001 |
| Height (cm)a | 158.8(7.2) | 156(5.2) | 167.6(5.5) | <0.001 |
| BMI (kg/m2)a | 23.3(3.1) | 23.2(3.1) | 23.8(2.8) | 0.003 |
| Waist circumference (cm)a | 83.8(8.6) | 83.2(8.5) | 85.6(8.5) | <0.001 |
| Daily dietary intakea | 　 | 　 | 　 | 　 |
| Energy (kcal/d) | 1814.8(485.7) | 1759.5(459.9) | 1993.2(523.2) | <0.001 |
| Protein (g/d)b | 75.6(10.1) | 76.7(10) | 72.1(9.6) | <0.001 |
| Betaine (mg/d)b | 259(120.1) | 258.6(120.8) | 260.4(117.9) | 0.882 |
| Choline (mg/d)b | 270.7(76.7) | 275.9(78.1) | 253.7(69.5) | <0.001 |
| Skeletal muscle mass | 　 | 　 | 　 | 　 |
| Arms (kg) | 3.8(1.1) | 3.3(0.5) | 5.4(0.7) | <0.001 |
| Legs (kg) | 12.2(2.5) | 11.1(1.5) | 15.7(2) | <0.001 |
| Limbs (kg) | 16(3.5) | 14.4(1.9) | 21.1(2.7) | <0.001 |
| ASMI (kg/m2) | 6.3(1) | 5.9(0.7) | 7.5(0.8) | <0.001 |
| Use of multivitamins, n (%) | 332(26.7) | 293(30.9) | 39(13.3) | <0.001 |
| Physical activity level, n (%) | 　 | 　 | 　 | 0.073 |
| Low | 414(33.3) | 305(32.3) | 109(37.1) | 　 |
| Middle | 424(34.1) | 319(33.6) | 105(35.7) | 　 |
| High | 404(32.5) | 324(34.2) | 80(27.2) | 　 |

Abbreviations: SD, standard deviation; BMI, body mass index; ASMI, appendicular skeletal muscle index.

a Values are presented as mean (SD).

b Nutrient intake was adjusted for energy intake using the residual method.

Supplementtable 2. Adjusted regression coefficients (and SEs) for relative change (Δ)a in skeletal muscle mass per 1 SD of energy-adjusted dietary betaine intake in middle-aged adults from the Guangzhou Nutrition and Health Study.

|  |  |  |  |
| --- | --- | --- | --- |
| 　 | Men | 　 | Women |
| 　 | *β* | SE | *P* value | 　 | *β* | SE | *P* value |
| ΔSMM of arms |  |  |  |  |  |  |
| Model 1b | 0.695 | 0.303 | 0.023 |  | 0.207 | 0.205 | 0.312 |
| Model 2c | 0.805 | 0.312 | 0.010 |  | 0.209 | 0.207 | 0.312 |
| ΔSMM of legs |  |  |  |  |  |  |
| Model 1b | 0.508 | 0.307 | 0.100 |  | 0.266 | 0.180 | 0.139 |
| Model 2c | 0.598 | 0.316 | 0.060 |  | 0.271 | 0.181 | 0.136 |
| ΔSMM of limbs |  |  |  |  |  |  |
| Model 1b | 0.536 | 0.281 | 0.057 |  | 0.244 | 0.162 | 0.132 |
| Model 2c | 0.632 | 0.289 | 0.029 |  | 0.245 | 0.163 | 0.134 |
| ΔASMI |  |  |  |  |  |  |  |
| Model 1b | 0.560 | 0.288 | 0.053 |  | 0.240 | 0.165 | 0.147 |
| Model 2c | 0.661 | 0.296 | 0.026 | 　 | 0.234 | 0.167 | 0.162 |

SMM, skeletal muscle mass; ASMI, appendicular skeletal muscle mass index.

a Relative change (Δ) in SMM or ASMI= ([SMM or ASMI in GNHS 2014-2017] – [SMM or ASMI in GNHS 2011-2013]) / [SMM or ASMI in GNHS 2011-2013] \* 100%.

b Model 1 was adjusted for age, sex, energy intake, baseline SMM or ASMI, waist circumference, and height.

c Model 2 was adjusted for variables in model 1 + physical activity level, protein intake, choline intake and use of multivitamins and menopause (for women)

Supplement table 3. The marginal mean of SMM relative change (%) over three years estimated by tertiles (T) of energy-adjusted dietary betaine intake.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 　 | T1 |  | T2 |  | T3 |  | *P*-trend |
| 　 | Mean (SE) |  | Mean (SE) |  | Mean (SE) |  |
| Women |  |  |  |  |  |  |  |
| ΔSMM of arms | -2.19(0.50) a |  | -1.83(0.47) a |  | -1.78(0.48) a |  | 0.432 |
| ΔSMM of legs | -1.59(0.44) a |  | -1.69(0.42) a |  | -0.84(0.42) a |  | 0.077 |
| ΔSMM of limbs | -1.75(0.39) a |  | -1.72(0.37) a |  | -1.08(0.38) a |  | 0.086 |
| ΔASMI | -1.37(0.40) a |  | -1.34(0.38) a |  | -0.76(0.39) a |  | 0.124 |
| Men |  |  |  |  |  |  |  |
| ΔSMM of arms | -2.40(0.62)a | -3.22(0.62) b |  | -1.09(0.63) ac |  | 0.045 |
| ΔSMM of legs | -0.77(0.63) a | -0.11(0.63) a | 0.63(0.64) a |  | 0.071 |
| ΔSMM of limbs | -1.16(0.58) a |  | -0.93(0.57) a | 0.16(0.58) a |  | 0.050 |
| ΔASMI | -1.05(0.59) a |  | -0.52(0.59) a |  | 0.44(0.60) a |  | 0.038 |

SMM, skeletal muscle mass; ASMI, appendicular skeletal muscle mass index.

Relative change (Δ) in SMM or ASMI= ([SMM or ASMI in GNHS 2014-2017] – [SMM or ASMI in GNHS 2011-2013]) / [SMM or ASMI in GNHS 2011-2013] \* 100%.

Adjusted model for ANCOVA includes age, sex, energy intake, baseline SMM or ASMI, waist circumference, height, physical activity level, protein intake, choline intake and use of multivitamins.

Comparing the same parts with each other, the same letter indicates no statistical significance, and different letters indicate statistical differences.