# Supplementary Table 1: Descriptions of different exposures.

|  |  |  |  |
| --- | --- | --- | --- |
| 　Parameters | **Definitions** | **Calculation** | **Implications** |
| **Muscle mass indices (kg/m2)** |  |  | The absolute muscle mass is affected by height. Muscle mass indices are relative measures of muscle mass controlling for the influence of height. |
| Appendicular muscle mass index  | The amount of appendicular muscle divided by height squared | (Arm muscle mass + leg muscle mass) / (Height)2 |
| Total muscle mass index  | The total amount of muscle in human bodies divided by height squared | (Arm muscle mass + leg muscle mass + trunk muscle mass) / (Height)2 |
| Arm muscle mass index  | The amount of muscle arms divided by height squared | Arm muscle mass / (Height)2 |
| Leg muscle mass index  | The amount of muscle in legs divided by height squared | Leg muscle mass / (Height)2 |
| Trunk muscle mass index  | The amount of muscle in the trunk divided by height squared | Trunk muscle mass / (Height)2 |
| **Grip strength (kg)** | Strength of the upper limb | Measured by hydraulic hand dynamometer (Jamar J00105) | An important index for muscle strength in the upper limb |
| **Arm muscle quality (kg/kg)** | Grip strength for per unit of muscle mass in the upper limb | Grip strength / arm muscle mass | Muscle strength decays faster than muscle mass with aging. Arm muscle quality reflects the muscle strength adjusted for mucle mass in the upper limb.  |

|  |  |
| --- | --- |
|  |  |

# Supplementary Figure 1: Restricted cubic splines for associations of grip strength and arm muscle quality with all-cause mortality. The four knots for restricted cubic splines were set at the 5th, 35th, 65th, and 95th percentages of grip strength (or arm muscle quality) and the lowest values of corresponding indices were the reference points. Solid lines represent hazard ratios and dashed lines represent 95% confidence intervals. Likelihood ratio tests were used to test for non-linearity (grip strength: *P*=0.815; arm muscle quality: *P*=0.156). Models were adjusted for variables in model 3 of Table 2.

# Supplementary Table 2: Sensitivity analyses for associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality

| **Muscle mass indices** | **Binary Category** |  | **Quintiles** |
| --- | --- | --- | --- |
| **Normal** | **Low** |  | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** |
| **Appendicular muscle mass index** |
| Model 3a | 1.00  | 1.20 (1.03-1.41) |  | 1.19 (0.96-1.48) | 0.94 (0.74-1.18) | 1.00  | 1.00 (0.78-1.27) | 1.06 (0.83-1.36) |
| Model 3b | 1.00  | 1.24 (1.03-1.49) |  | 1.26 (0.98-1.63) | 0.96 (0.73-1.27) | 1.00  | 1.09 (0.82-1.44) | 1.10 (0.82-1.47) |
| Model 3c | 1.00  | 1.26 (1.04-1.52) |  | 1.29 (0.99-1.68) | 1.00 (0.75-1.34) | 1.00  | 1.03 (0.76-1.40) | 1.13 (0.82-1.54) |
| Model 3d | 1.00  | 1.22 (0.97-1.54) |  | 1.23 (0.91-1.68) | 1.06 (0.76-1.47) | 1.00  | 0.87 (0.61-1.24) | 1.11 (0.79-1.56) |
| **Total muscle mass index** |
| Model 3a | 1.00  | 1.31 (1.11-1.53) |  | 1.32 (1.07-1.63) | 0.98 (0.78-1.24) | 1.00  | 1.05 (0.83-1.33) | 1.05 (0.82-1.34) |
| Model 3b | 1.00  | 1.24 (1.03-1.49) |  | 1.18 (0.93-1.50) | 0.90 (0.69-1.18) | 1.00  | 0.94 (0.72-1.24) | 0.99 (0.74-1.31) |
| Model 3c | 1.00  | 1.38 (1.14-1.67) |  | 1.34 (1.04-1.72) | 0.97 (0.73-1.28) | 1.00  | 0.90 (0.66-1.21) | 1.02 (0.75-1.38) |
| Model 3d | 1.00  | 1.25 (0.99-1.58) |  | 1.32 (0.97-1.80) | 1.07 (0.77-1.50) | 1.00  | 1.18 (0.84-1.65) | 0.92 (0.64-1.33) |
| **Arm muscle mass index** |
| Model 3a | 1.00  | 1.44 (1.23-1.68) |  | 1.28 (1.04-1.58) | 0.84 (0.66-1.06) | 1.00  | 0.94 (0.73-1.20) | 0.79 (0.61-1.02) |
| Model 3b | 1.00  | 1.42 (1.18-1.71) |  | 1.26 (0.98-1.60) | 0.82 (0.62-1.07) | 1.00  | 0.97 (0.73-1.28) | 0.75 (0.55-1.01) |
| Model 3c | 1.00  | 1.61 (1.33-1.94) |  | 1.34 (1.04-1.72) | 0.75 (0.56-1.01) | 1.00  | 0.81 (0.59-1.10) | 0.76 (0.55-1.04) |
| Model 3d | 1.00  | 1.43 (1.13-1.80) |  | 1.34 (0.99-1.83) | 0.96 (0.69-1.35) | 1.00  | 0.99 (0.70-1.40) | 0.77 (0.53-1.11) |
| **Leg muscle mass index** |
| Model 3a | 1.00  | 1.11 (0.94-1.30) |  | 1.11 (0.89-1.37) | 0.95 (0.75-1.20) | 1.00  | 0.96 (0.75-1.23) | 1.15 (0.91-1.46) |
| Model 3b | 1.00  | 1.11 (0.92-1.34) |  | 1.12 (0.87-1.45) | 0.97 (0.73-1.27) | 1.00  | 0.97 (0.73-1.30) | 1.17 (0.88-1.55) |
| Model 3c | 1.00  | 1.14 (0.93-1.38) |  | 1.19 (0.91-1.56) | 1.04 (0.78-1.40) | 1.00  | 0.97 (0.71-1.33) | 1.23 (0.90-1.68) |
| Model 3d | 1.00  | 1.12 (0.89-1.42) |  | 1.19 (0.86-1.64) | 1.14 (0.81-1.59) | 1.00  | 0.91 (0.63-1.30) | 1.19 (0.85-1.67) |
| **Trunk muscle mass index** |
| Model 3a | 1.00  | 1.48 (1.25-1.75) |  | 1.43 (1.15-1.78) | 0.95 (0.75-1.20) | 1.00  | 0.96 (0.76-1.21) | 0.97 (0.77-1.22) |
| Model 3b | 1.00  | 1.41 (1.15-1.72) |  | 1.27 (0.99-1.64) | 0.79 (0.60-1.05) | 1.00  | 0.96 (0.74-1.24) | 0.89 (0.68-1.17) |
| Model 3c | 1.00  | 1.54 (1.26-1.90) |  | 1.53 (1.17-2.01) | 0.99 (0.73-1.33) | 1.00  | 1.04 (0.78-1.38) | 0.93 (0.69-1.25) |
| Model 3d | 1.00  | 1.71 (1.33-2.19) |  | 1.43 (1.04-1.97) | 0.61 (0.42-0.90) | 1.00  | 1.05 (0.76-1.45) | 0.77 (0.54-1.09) |
| **Grip strength** |
| Model 3a | 1.00  | 1.65 (1.40-1.94) |  | 2.26 (1.60-3.20) | 1.62 (1.15-2.28) | 1.17 (0.82-1.67) | 1.13 (0.78-1.62) | 1.00  |
| Model 3b | 1.00  | 1.57 (1.30-1.89) |  | 1.95 (1.33-2.88) | 1.48 (1.00-2.18) | 1.07 (0.71-1.60) | 0.98 (0.65-1.50) | 1.00  |
| Model 3c | 1.00  | 1.74 (1.42-2.13) |  | 1.97 (1.30-3.00) | 1.38 (0.90-2.10) | 0.88 (0.56-1.38) | 0.87 (0.55-1.39) | 1.00  |
| Model 3d | 1.00  | 1.59 (1.26-2.02) |  | 1.74 (1.09-2.79) | 1.30 (0.80-2.09) | 0.82 (0.49-1.37) | 1.00 (0.60-1.68) | 1.00  |
| **Arm muscle quality** |
| Model 3a | 1.00  | 1.38 (1.18-1.60) |  | 1.48 (1.19-1.84) | 1.26 (1.00-1.59) | 1.00  | 0.84 (0.64-1.11) | 1.02 (0.76-1.35) |
| Model 3b | 1.00  | 1.33 (1.11-1.59) |  | 1.41 (1.10-1.82) | 1.19 (0.91-1.55) | 1.00  | 0.89 (0.65-1.22) | 1.05 (0.76-1.45) |
| Model 3c | 1.00  | 1.41 (1.17-1.70) |  | 1.58 (1.20-2.08) | 1.30 (0.97-1.73) | 1.00  | 0.88 (0.62-1.25) | 1.20 (0.85-1.71) |
| Model 3d | 1.00  | 1.26 (1.00-1.58) | 　 | 1.33 (0.97-1.84) | 1.18 (0.84-1.65) | 1.00  | 0.87 (0.57-1.31) | 1.05 (0.68-1.62) |

All the analyses were conducted based on model 3 of Table 2.

Model 3a: including participants with self-reported diagnosis of cardiovascular diseases or cancer and was additionally adjusted for self-reported diagnosis of cardiovascular diseases or cancer.

Model 3b: excluding participants who died within the first year of follow-up.

Model 3c: excluding participants whose body weight changed more than 2.5 kg during the past 1 year.

Model 3d: Excluding participants who ever smoked.

# Supplementary Table 3: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by sex

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **Male** |  | **Female** | ***P*int** |
| **Normal** | **Low** |  | **Reference** **group** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |
| Person-years | 27,251 | 6,555 |  | 44,787  | 11,163  |  |
| No. of death | 222 | 176 |  | 243  | 98  |  |
| Crude mortality\* | 8.2 | 26.9 |  | 5.4 | 8.8 |  |
| HR (95% CI) | 1.00  | 1.34 (1.06-1.69) |  | 1.00  | 1.17 (0.91-1.50) | 0.243 |
| **Total muscle mass index** |
| Person-years | 27,252 | 6,553 |  | 44,722  | 11,228  |  |
| No. of death | 235 | 163 |  | 245  | 96  |  |
| Crude mortality\* | 8.6 | 24.9 |  | 5.5 | 8.6 |  |
| HR (95% CI) | 1.00  | 1.51 (1.20-1.89) |  | 1.00  | 1.17 (0.90-1.52) | 0.068 |
| **Arm muscle mass index** |
| Person-years | 27,265 | 6,540 |  | 44,446  | 11,504  |  |
| No. of death | 210 | 188 |  | 238  | 103  |  |
| Crude mortality\* | 7.7 | 28.8 |  | 5.4 | 9.0 |  |
| HR (95% CI) | 1.00  | 1.59 (1.26-2.00) |  | 1.00  | 1.43 (1.11-1.86) | 0.377 |
| **Leg muscle mass index** |
| Person-years | 27,209 | 6,597 |  | 44,612  | 11,338  |  |
| No. of death | 232 | 166 |  | 243  | 98  |  |
| Crude mortality\* | 8.5 | 25.2 |  | 5.5 | 8.6 |  |
| HR (95% CI) | 1.00  | 1.16 (0.92-1.47) |  | 1.00  | 1.07 (0.83-1.38) | 0.369 |
| **Trunk muscle mass index** |
| Person-years | 27,208 | 6,597 |  | 44,763  | 11,187  |  |
| No. of death | 264 | 134 |  | 229  | 112  |  |
| Crude mortality\* | 9.7 | 20.3 |  | 5.1 | 10.0 |  |
| HR (95% CI) | 1.00  | 1.51 (1.18-1.92) |  | 1.00  | 1.61 (1.23-2.12) | 0.832 |
| **Grip strength** |
| Person-years | 27,361 | 6,445 |  | 44,902  | 11,048  |  |
| No. of death | 176 | 222 |  | 175  | 166  |  |
| Crude mortality\* | 6.43 | 34.5 |  | 3.9 | 15.0 |  |
| HR (95% CI) | 1.00  | 1.93 (1.52-2.46) |  | 1.00  | 1.47 (1.13-1.90) | 0.117 |
| **Arm muscle quality** |
| Person-years | 27,171 | 6,634 |  | 44,823  | 11,127  |  |
| No. of death | 230 | 168 |  | 194  | 147  |  |
| Crude mortality\* | 8.5 | 25.3 |  | 4.3  | 13.2  |  |
| HR (95% CI) | 1.00  | 1.72 (1.38-2.14) | 　 | 1.00  | 1.18 (0.92-1.52) | 0.061 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2, except for sex.

\* Per 1000 person-years.

**Supplementary Table 4: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by age.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters　 | **Age <60 years**  |  | **Age ≥60 years** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |
| Person-years | 42,717  | 7,063  |  | 29,321  | 10,655  |  |
| No. of death | 93  | 27  |  | 372  | 247  |  |
| Crude mortality\* | 2.2  | 3.8  |  | 12.7  | 23.2  |  |
| HR (95% CI) | 1.00  | 1.77 (1.13-2.78) |  | 1.00  | 1.23 (1.03-1.48) | 0.150 |
| **Total muscle mass index** |
| Person-years | 42,246  | 7,533  |  | 29,728  | 10,247  |  |
| No. of death | 93  | 27  |  | 387  | 232  |  |
| Crude mortality\* | 2.2  | 3.6  |  | 13.0  | 22.6  |  |
| HR (95% CI) | 1.00  | 1.68 (1.07-2.65) |  | 1.00  | 1.35 (1.13-1.61) | 0.360 |
| **Arm muscle mass index** |
| Person-years | 42,366  | 7,414  |  | 29,346  | 10,630  |  |
| No. of death | 91  | 29  |  | 357  | 262  |  |
| Crude mortality\* | 2.2  | 3.9  |  | 12.2  | 24.7  |  |
| HR (95% CI) | 1.00  | 2.05 (1.30-3.22) |  | 1.00  | 1.49 (1.25-1.79) | 0.254 |
| **Leg muscle mass index** |
| Person-years | 42,615  | 7,165  |  | 29,207  | 10,769  |  |
| No. of death | 95  | 25  |  | 380  | 239  |  |
| Crude mortality\* | 2.2  | 3.5  |  | 13.0  | 22.2  |  |
| HR (95% CI) | 1.00  | 1.49 (0.94-2.35) |  | 1.00  | 1.12 (0.93-1.34) | 0.244 |
| **Trunk muscle mass index** |
| Person-years | 42,296  | 7,483  |  | 29,675  | 10,301  |  |
| No. of death | 94  | 26  |  | 399  | 220  |  |
| Crude mortality\* | 2.2  | 3.5  |  | 13.5  | 21.4  |  |
| HR (95% CI) | 1.00  | 1.66 (1.03-2.65) |  | 1.00  | 1.57 (1.29-1.90) | 0.731 |
| **Grip strength** |  |  |  |  |  |  |
| Person-years | 45,868  | 3,912  |  | 26,395  | 13,581  |  |
| No. of death | 94  | 26  |  | 257  | 362  |  |
| Crude mortality\* | 2.1  | 6.7  |  | 9.7  | 26.7  |  |
| HR (95% CI) | 1.00  | 2.47 (1.54-3.96) |  | 1.00  | 1.58 (1.32-1.90) | 0.089 |
| **Arm muscle quality** |  |  |  |  |  |  |
| Person-years | 44,171  | 5,609  |  | 27,824  | 12,152  |  |
| No. of death | 98  | 22  |  | 326  | 293  |  |
| Crude mortality\* | 2.2  | 3.9  |  | 11.7  | 24.1  |  |
| HR (95% CI) | 1.00  | 1.30 (0.79-2.12) | 　 | 1.00  | 1.42 (1.19-1.69) | 0.853 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2.

\* Per 1000 person-years.

**Supplementary Table 5: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by residential areas**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters　　 | **Urban areas** |  | **Rural areas** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |  |  |  |  |  |  |
| **Appendicular muscle mass index** |  |  |  |  |  |  |
| Person-years | 30,788  | 7,593  |  | 41,250  | 10,124  |  |
| No. of death | 189  | 89  |  | 276  | 185  |  |
| Crude mortality \* | 6.1  | 11.7  |  | 6.7  | 18.3  |  |
| HR (95% CI) | 1.00  | 1.40 (1.06-1.85) |  | 1.00  | 1.21 (0.98-1.50) | 0.756 |
| **Total muscle mass index** |  |  |  |  |  |  |
| Person-years | 29,622  | 8,759  |  | 42,352  | 9,022  |  |
| No. of death | 182  | 96  |  | 298  | 163  |  |
| Crude mortality \* | 6.1  | 11.0  |  | 7.0  | 18.1  |  |
| HR (95% CI) | 1.00  | 1.47 (1.11-1.94) |  | 1.00  | 1.33 (1.08-1.64) | 0.956 |
| **Arm muscle mass index** |  |  |  |  |  |  |
| Person-years | 29,341  | 9,041  |  | 42,371  | 9,003  |  |
| No. of death | 168  | 110  |  | 280  | 181  |  |
| Crude mortality \* | 5.7  | 12.2  |  | 6.6  | 20.1  |  |
| HR (95% CI) | 1.00  | 1.71 (1.29-2.27) |  | 1.00  | 1.46 (1.19-1.80) | 0.871 |
| **Leg muscle mass index** |  |  |  |  |  |  |
| Person-years | 31,051  | 7,331  |  | 40,770  | 10,604  |  |
| No. of death | 198  | 80  |  | 277  | 184  |  |
| Crude mortality \* | 6.4  | 10.9  |  | 6.8  | 17.4  |  |
| HR (95% CI) | 1.00  | 1.25 (0.94-1.66) |  | 1.00  | 1.09 (0.88-1.35) | 0.867 |
| **Trunk muscle mass index** |  |  |  |  |  |  |
| Person-years | 29,191  | 9,191  |  | 42,781  | 8,594  |  |
| No. of death | 177  | 101  |  | 316  | 145  |  |
| Crude mortality\* | 6.1  | 11.0  |  | 7.4  | 16.9  |  |
| HR (95% CI) | 1.00  | 1.87 (1.37-2.55) |  | 1.00  | 1.47 (1.18-1.84) | 0.680 |
| **Grip strength** |  |  |  |  |  |  |
| Person-years | 30,924  | 7,458  |  | 41,339  | 10,035  |  |
| No. of death | 144  | 134  |  | 207  | 254  |  |
| Crude mortality\* | 4.7  | 18.0  |  | 5.0  | 25.3  |  |
| HR (95% CI) | 1.00  | 1.79 (1.35-2.36) |  | 1.00  | 1.62 (1.30-2.02) | 0.926 |
| **Arm muscle quality** |  |  |  |  |  |  |
| Person-years | 30,975  | 7,406  |  | 41,020  | 10,355  |  |
| No. of death | 167  | 111  |  | 257  | 204  |  |
| Crude mortality\* | 5.4  | 15.0  |  | 6.3  | 19.7  |  |
| HR (95% CI) | 1.00  | 1.35 (1.03-1.75) | 　 | 1.00  | 1.45 (1.18-1.79) | 0.595 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2.

\* Per 1000 person-years.

**Supplementary Table 6: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by total levels of physical activities**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters　 | **Low levels of physical activity** |  | **High levels of physical activity** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |
| Person-years | 33,995  | 10,339  |  | 38,043  | 7,378  |  |
| No. of death | 324  | 235  |  | 141  | 39  |  |
| Crude mortality\* | 9.5 | 22.7 |  | 3.7  | 5.3  |  |
| HR (95% CI) | 1.00  | 1.39 (1.15-1.68) |  | 1.00  | 0.97 (0.65-1.44) | 0.010 |
| **Total muscle mass index** |  |  |  |  |  |  |
| Person-years | 34,243  | 10,091  |  | 37,732  | 7,690  |  |
| No. of death | 348  | 211  |  | 132  | 48  |  |
| Crude mortality\* | 10.2 | 20.9 |  | 3.5  | 6.2  |  |
| HR (95% CI) | 1.00  | 1.36 (1.13-1.64) |  | 1.00  | 1.41 (0.97-2.04) | 0.862 |
| **Arm muscle mass index** |
| Person-years | 34,040  | 10,294  |  | 37,672  | 7,750  |  |
| No. of death | 315  | 244  |  | 133  | 47  |  |
| Crude mortality\* | 9.3 | 23.7 |  | 3.5  | 6.1  |  |
| HR (95% CI) | 1.00  | 1.62 (1.34-1.96) |  | 1.00  | 1.27 (0.87-1.85) | 0.094 |
| **Leg muscle mass index** |
| Person-years | 33,864  | 10,470  |  | 37,957  | 7,465  |  |
| No. of death | 334  | 225  |  | 141  | 39  |  |
| Crude mortality\* | 9.9 | 21.5 |  | 3.7  | 5.2  |  |
| HR (95% CI) | 1.00  | 1.23 (1.01-1.48) |  | 1.00  | 0.96 (0.64-1.43) | 0.023 |
| **Trunk muscle mass index** |
| Person-years | 34,503  | 9,831  |  | 37,468  | 7,953  |  |
| No. of death | 361  | 198  |  | 132  | 48  |  |
| Crude mortality\* | 10.5 | 20.1 |  | 3.5  | 6.0  |  |
| HR (95% CI) | 1.00  | 1.56 (1.27-1.91) |  | 1.00  | 1.55 (1.04-2.30) | 0.652 |
| **Grip strength** |
| Person-years | 32,325  | 12,009  |  | 39,938  | 5,484  |  |
| No. of death | 217  | 342  |  | 134  | 46  |  |
| Crude mortality\* | 6.7 | 28.5 |  | 3.4  | 8.4  |  |
| HR (95% CI) | 1.00  | 1.93 (1.58-2.35) |  | 1.00  | 0.99 (0.67-1.47) | 0.005 |
| **Arm muscle quality** |
| Person-years | 32,834  | 11,500  |  | 39,160  | 6,261  |  |
| No. of death | 291  | 268  |  | 133  | 47  |  |
| Crude mortality\* | 8.9 | 23.3 |  | 3.4  | 7.5  |  |
| HR (95% CI) | 1.00  | 1.50 (1.25-1.80) | 　 | 1.00  | 1.15 (0.79-1.67) | 0.370 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2, except for physical activities.

\* Per 1000 person-years.

**Supplementary Table 7: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by levels of leisure physical activities**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters　 | **Without leisure physical activities** |  | **With leisure physical activities** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |  |  |  |  |  |  |
| Person-years | 46,558  | 11,775  |  | 25,480  | 5,943  |  |
| No. of death | 287  | 197  |  | 178  | 77  |  |
| Crude mortality\* | 6.2  | 16.7  |  | 7.0  | 13.0  |  |
| HR (95% CI) | 1.00  | 1.39 (1.13-1.71) |  | 1.00  | 1.14 (0.85-1.55) | 0.190 |
| **Total muscle mass index** |  |  |  |  |  |  |
| Person-years | 46,734  | 11,599  |  | 25,241  | 6,182  |  |
| No. of death | 312  | 172  |  | 168  | 87  |  |
| Crude mortality\* | 6.7  | 14.8  |  | 6.7  | 14.1  |  |
| HR (95% CI) | 1.00  | 1.36 (1.10-1.66) |  | 1.00  | 1.61 (1.20-2.17) | 0.566 |
| **Arm muscle mass index** |
| Person-years | 46,651  | 11,682  |  | 25,060  | 6,362  |  |
| No. of death | 286  | 198  |  | 162  | 93  |  |
| Crude mortality\* | 6.1  | 17.0  |  | 6.5  | 14.6  |  |
| HR (95% CI) | 1.00  | 1.57 (1.28-1.93) |  | 1.00  | 1.59 (1.19-2.14) | 0.909 |
| **Leg muscle mass index** |
| Person-years | 46,411  | 11,922  |  | 25,410  | 6,013  |  |
| No. of death | 297  | 187  |  | 178  | 77  |  |
| Crude mortality\* | 6.4  | 15.7  |  | 7.0  | 12.8  |  |
| HR (95% CI) | 1.00  | 1.21 (0.98-1.49) |  | 1.00  | 1.13 (0.83-1.52) | 0.464 |
| **Trunk muscle mass index** |
| Person-years | 46,653  | 11,680  |  | 25,318  | 6,105  |  |
| No. of death | 320  | 164  |  | 173  | 82  |  |
| Crude mortality\* | 6.9  | 14.0  |  | 6.8  | 13.4  |  |
| HR (95% CI) | 1.00  | 1.60 (1.28-1.99) |  | 1.00  | 1.72 (1.25-2.39) | 0.978 |
| **Grip strength** |
| Person-years | 47,136  | 11,197  |  | 25,127  | 6,295  |  |
| No. of death | 218  | 266  |  | 133  | 122  |  |
| Crude mortality\* | 4.6  | 23.8  |  | 5.3  | 19.4  |  |
| HR (95% CI) | 1.00  | 1.72 (1.39-2.14) |  | 1.00  | 1.49 (1.10-2.00) | 0.215 |
| **Arm muscle quality** |
| Person-years | 47,187  | 11,146  |  | 24,807  | 6,615  |  |
| No. of death | 270  | 214  |  | 154  | 101  |  |
| Crude mortality\* | 5.7  | 19.2  |  | 6.2  | 15.3  |  |
| HR (95% CI) | 1.00  | 1.51 (1.23-1.86) | 　 | 1.00  | 1.17 (0.88-1.54) | 0.073 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2, except for physical activities.

\* Per 1000 person-years.

**Supplementary Table 8: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by body mass index**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **BMI<24 kg/m2** |  | **BMI≥24 kg/m2** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |  |  |  |  |  |  |
| Person-years | 27,477  | 16,909  |  | 44,561  | 809  |  |
| No. of death | 182  | 264  |  | 283  | 10  |  |
| Crude mortality\* | 6.6  | 15.6  |  | 6.4  | 12.4  |  |
| HR (95% CI) | 1.00  | 1.23 (1.00-1.52) |  | 1.00  | 0.99 (0.50-1.97) | 0.984 |
| **Total muscle mass index** |  |  |  |  |  |  |
| Person-years | 27,357  | 17,029  |  | 44,618  | 752  |  |
| No. of death | 196  | 250  |  | 284  | 9  |  |
| Crude mortality\* | 7.2  | 14.7  |  | 6.4  | 12.0  |  |
| HR (95% CI) | 1.00  | 1.34 (1.09-1.64) |  | 1.00  | 1.15 (0.56-2.34) | 0.995 |
| **Arm muscle mass index** |
| Person-years | 27,777  | 16,609  |  | 43,934  | 1,435  |  |
| No. of death | 173  | 273  |  | 275  | 18  |  |
| Crude mortality\* | 6.2  | 16.4  |  | 6.3  | 12.5  |  |
| HR (95% CI) | 1.00  | 1.64 (1.33-2.03) |  | 1.00  | 1.21 (0.71-2.08) | 0.577 |
| **Leg muscle mass index** |
| Person-years | 27,391  | 16,995  |  | 44,431  | 939  |  |
| No. of death | 195  | 251  |  | 280  | 13  |  |
| Crude mortality\* | 7.1  | 14.8  |  | 6.3  | 13.9  |  |
| HR (95% CI) | 1.00  | 1.03 (0.83-1.27) |  | 1.00  | 1.11 (0.60-2.04) | 0.393 |
| **Trunk muscle mass index** |
| Person-years | 28,820  | 15,566  |  | 43,151  | 2,219  |  |
| No. of death | 232  | 214  |  | 261  | 32  |  |
| Crude mortality\* | 8.1  | 13.8  |  | 6.1  | 14.4  |  |
| HR (95% CI) | 1.00  | 1.50 (1.20-1.86) |  | 1.00  | 1.56 (0.95-2.57) | 0.804 |
| **Grip strength** |
| Person-years | 34,415  | 9,971  |  | 37,848  | 7,521  |  |
| No. of death | 178  | 268  |  | 173  | 120  |  |
| Crude mortality\* | 5.2  | 26.9  |  | 4.6  | 16.0  |  |
| HR (95% CI) | 1.00  | 1.95 (1.55-2.45) |  | 1.00  | 1.33 (1.01-1.76) | 0.101 |
| **Arm muscle quality** |
| Person-years | 37,788  | 6,598  |  | 34,206  | 11,163  |  |
| No. of death | 273  | 173  |  | 151  | 142  |  |
| Crude mortality\* | 7.2  | 26.2  |  | 4.4  | 12.7  |  |
| HR (95% CI) | 1.00  | 1.60 (1.29-1.99) | 　 | 1.00  | 1.31 (1.02-1.70) | 0.180 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2.

\* Per 1000 person-years.

**Supplementary Table 9: Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by waist circumference**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **Waist circumference <85 (Male)/80(Female)** |  | **Waist circumference ≥85 (Male)/80(Female)** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |
| Person-years | 22,051  | 13,518  |  | 49,987  | 4,199  |  |
| No. of death | 137  | 222  |  | 328  | 52  |  |
| Crude mortality\* | 6.2  | 16.4  |  | 6.6  | 12.4  |  |
| HR (95% CI) | 1.00  | 1.23 (0.97-1.57) |  | 1.00  | 1.01 (0.73-1.40) | 0.444 |
| **Total muscle mass index** |
| Person-years | 21,973  | 13,596  |  | 50,001  | 4,185  |  |
| No. of death | 148  | 211  |  | 332  | 48  |  |
| Crude mortality\* | 6.7  | 15.5  |  | 6.6  | 11.5  |  |
| HR (95% CI) | 1.00  | 1.28 (1.01-1.61) |  | 1.00  | 1.22 (0.87-1.69) | 0.761 |
| **Arm muscle mass index** |
| Person-years | 21,923  | 13,646  |  | 49,788  | 4,398  |  |
| No. of death | 122  | 237  |  | 326  | 54  |  |
| Crude mortality\* | 5.6  | 17.4  |  | 6.6  | 12.3  |  |
| HR (95% CI) | 1.00  | 1.58 (1.24-2.02) |  | 1.00  | 1.32 (0.96-1.82) | 0.327 |
| **Leg muscle mass index** |
| Person-years | 22,362  | 13,207  |  | 49,459  | 4,727  |  |
| No. of death | 153  | 206  |  | 322  | 58  |  |
| Crude mortality\* | 6.8  | 15.6  |  | 6.5  | 12.3  |  |
| HR (95% CI) | 1.00  | 1.05 (0.83-1.34) |  | 1.00  | 0.97 (0.72-1.33) | 0.818 |
| **Trunk muscle mass index** |
| Person-years | 22,890  | 12,680  |  | 49,082  | 5,104  |  |
| No. of death | 177  | 182  |  | 316  | 64  |  |
| Crude mortality\* | 7.7  | 14.4  |  | 6.4  | 12.5  |  |
| HR (95% CI) | 1.00  | 1.42 (1.12-1.80) |  | 1.00  | 1.56 (1.13-2.17) | 0.893 |
| **Grip strength** |
| Person-years | 27,615  | 7,954  |  | 44,648  | 9,538  |  |
| No. of death | 139  | 220  |  | 212  | 168  |  |
| Crude mortality\* | 5.0  | 27.7  |  | 4.8  | 17.6  |  |
| HR (95% CI) | 1.00  | 1.89 (1.46-2.43) |  | 1.00  | 1.43 (1.12-1.82) | 0.088 |
| **Arm muscle quality** |
| Person-years | 30,587  | 4,982  |  | 41,407  | 12,779  |  |
| No. of death | 227  | 132  |  | 197  | 183  |  |
| Crude mortality\* | 7.4  | 26.5  |  | 4.8  | 14.3  |  |
| HR (95% CI) | 1.00  | 1.61 (1.26-2.06) | 　 | 1.00  | 1.36 (1.09-1.71) | 0.195 |

HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2.

\* Per 1000 person-years.

**Supplementary Table 10:. Associations of muscle mass indices, grip strength, and arm muscle quality with all-cause mortality by body fat percentage**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **BF% <20% (male)/30% (female)** |  | **BF% ≥20% (male)/30% (female)** | ***P*int** |
| **Normal** | **Low** |  | **Normal** | **Low** |
| **Muscle mass indices** |
| **Appendicular muscle mass index** |
| Person-years | 28,527  | 11,966  |  | 43,511  | 5,752  |  |
| No. of death | 173  | 188  |  | 292  | 86  |  |
| Crude mortality \* | 6.1  | 15.7  |  | 6.7  | 15.0  |  |
| HR (95% CI) | 1.00  | 1.22 (0.97-1.53) |  | 1.00  | 1.27 (0.96-1.67) | 0.969 |
| **Total muscle mass index** |
| Person-years | 29,341  | 11,152  |  | 42,633  | 6,629  |  |
| No. of death | 192  | 169  |  | 288  | 90  |  |
| Crude mortality\* | 6.5  | 15.2  |  | 6.8  | 13.6  |  |
| HR (95% CI) | 1.00  | 1.30 (1.03-1.64) |  | 1.00  | 1.39 (1.07-1.82) | 0.967  |
| **Arm muscle mass index** |
| Person-years | 29,348  | 11,145  |  | 42,364  | 6,898  |  |
| No. of death | 172  | 189  |  | 276  | 102  |  |
| Crude mortality\* | 5.9  | 17.0  |  | 6.5  | 14.8  |  |
| HR (95% CI) | 1.00  | 1.55 (1.23-1.95) |  | 1.00  | 1.48 (1.14-1.93) | 0.522  |
| **Leg muscle mass index** |
| Person-years | 28,299  | 12,194  |  | 43,522  | 5,741  |  |
| No. of death | 182  | 179  |  | 293  | 85  |  |
| Crude mortality\* | 6.4  | 14.7  |  | 6.7  | 14.8  |  |
| HR (95% CI) | 1.00  | 1.02 (0.81-1.29) |  | 1.00  | 1.24 (0.94-1.63) | 0.360  |
| **Trunk muscle mass index** |
| Person-years | 30,581  | 9,912  |  | 41,391  | 7,872  |  |
| No. of death | 218  | 143  |  | 275  | 103  |  |
| Crude mortality\* | 7.1  | 14.4  |  | 6.6  | 13.1  |  |
| HR (95% CI) | 1.00  | 1.48 (1.16-1.90) |  | 1.00  | 1.67 (1.27-2.21) | 0.830  |
| **Grip strength** |
| Person-years | 32,665  | 7,828  |  | 39,598  | 9,664  |  |
| No. of death | 163  | 198  |  | 188  | 190  |  |
| Crude mortality\* | 5.0  | 25.3  |  | 4.8  | 19.7  |  |
| HR (95% CI) | 1.00  | 1.66 (1.29-2.14) |  | 1.00  | 1.73 (1.36-2.20) | 0.954  |
| **Arm muscle quality** |
| Person-years | 34,216  | 6,277  |  | 37,778  | 11,484  |  |
| No. of death | 220  | 141  |  | 204  | 174  |  |
| Crude mortality\* | 6.4  | 22.5  |  | 5.4  | 15.2  |  |
| HR (95% CI) | 1.00  | 1.58 (1.24-2.01) | 　 | 1.00  | 1.36 (1.08-1.70) | 0.374  |

BF%=body fat percentage; HR=hazard ratio; CI=confidence interval.

Models were adjusted for the same variables as model 3 of Table 2.

\* Per 1000 person-years.

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