Supplemental Table 1 Baseline characteristics according to serum 25(OH)D quintiles (N=4342).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Characteristics | Quintile 1 | Quintile 2 | Quintile 3 | Quintile 4 | Quintile 5 | P trend | P trend |
| 25(OH)D levels (nmol/L): | (<52.44) | (52.44 to <58.88) | (58.88 to <65.37) | (65.37 to <73.11) | (≧73.11) | adjusted\* |
| N= | 869 | 869 | 868 | 868 | 868 |  |  |
| Age | 48.42 | ± | 17.67 | 50.54 | ± | 16.71 | 53.15 | ± | 16.13  | 54.88 | ± | 15.31  | 57.09 | ± | 13.46 | <0.001 |  |
| Female | 589 |  | 67.80% | 566 |  | 65.10% | 584 |  | 67.30% | 576 |  | 66.40% | 632 |  | 72.80% | 0.024 |  |
| Current smoker | 66 |  | 7.60% | 61 |  | 7.00% | 54 |  | 6.20% | 51 |  | 5.90% | 35 |  | 4.00% | 0.051 | 0.079 |
| Current drinker | 80 |  | 9.20% | 90 |  | 10.40% | 82 |  | 9.40% | 83 |  | 9.60% | 77 |  | 8.90% | 0.035 | 0.306 |
| Education level |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | <0.001 | <0.001 |
| pre-primary  | 53 |  | 6.10% | 43 |  | 4.90% | 69 |  | 7.90% | 80 |  | 9.20% | 107 |  | 12.30% |  |  |
| primary | 114 |  | 13.10% | 152 |  | 17.50% | 198 |  | 22.80% | 229 |  | 26.40% | 244 |  | 29.10% |  |  |
| secondary | 372 |  | 42.80% | 380 |  | 43.70% | 354 |  | 40.80% | 334 |  | 38.50% | 352 |  | 40.60% |  |  |
| college or university | 330 |  | 38.00% | 294 |  | 33.80% | 247 |  | 28.50% | 225 |  | 25.90% | 156 |  | 18.00% |  |  |
| Season |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | <0.001 | <0.001 |
| Winter/Spring | 456 |  | 52.50% | 375 |  | 43.20% | 339 |  | 39.10% | 322 |  | 37.10% | 309 |  | 35.60% |  |  |
| Summer/Autumn | 413 |  | 47.50% | 494 |  | 56.80% | 529 |  | 60.90% | 546 |  | 62.90% | 559 |  | 64.40% |  |  |
| BMI | 22.36 | ± | 3.99 | 22.62 | ± | 3.56 | 22.77 | ± | 3.57 | 22.77 | ± | 3.37 | 23.06 | ± | 3.45 | 0.236 | - |
| Femoral neck BMD T-score | -0.8424 | ± | 1.1616 | -0.8295 | **±** | 1.1260 | -0.8754 | ± | 1.1839 | -0.9109 | ± | 1.2021 | -1.0246 | ± | 1.1752 | 0.021 | <0.001 |
| Physical activities | 334 |  | 38.40% | 392 |  | 45.10% | 467 |  | 53.80% | 479 |  | 55.20% | 539 |  | 62.10% | <0.001 | <0.001 |
| Serum total calcium (mmol/L) | 2.374 | ± | 0.089  | 2.383 | ± | 0.084 | 2.397 | ± | 0.083 | 2.394 | ± | 0.084 | 2.40 | ± | 0.09 | 0.405 | <0.001 |
| Serum calcium(Alb-adj) (mmol/L)  | 2.289 | ± | 0.080 | 2.299 | ± | 0.076 | 2.312 | ± | 0.077  | 2.312 | ± | 0.079 | 2.32 | ± | 0.08 | <0.001 | <0.001 |
| Serum albumin (g/L)  | 44.24 | ± | 2.92 | 44.19 | ± | 2.72 | 44.25 | ± | 2.61 | 44.08 | ± | 2.75 | 43.99 | ± | 2.68 | 0.023 | 0.003 |
| Serum parathyroid hormone (pmol/L)  | 4.44 | ± | 1.76 | 4.05 | ± | 1.47 | 3.91 | ± | 1.43 | 3.82 | ± | 1.44 | 3.50 | ± | 1.35 | <0.001 | <0.001 |
| Serum alkaline phosphatase (mmol/L) | 68.20 | ± | 24.44  | 69.25 | ± | 22.78 | 69.82 | ± | 21.34 | 69.68 | ± | 21.03 | 73.19 | ± | 21.37 | <0.001 | 0.344 |
| Serum phosphate (mmol/L)  | 1.131 | ± | 0.158 | 1.128 | ± | 0.155 | 1.123 | ± | 0.149 | 1.118 | ± | 0.144 | 1.12 | ± | 0.14 | 0.109 | 0.188 |
| Serum 25(OH)D (nmol/L) | 47.14 | ± | 4,25  | 55.80 | ± | 1.86 | 62.04 | ± | 1.86 | 68.79 | ± | 2.25 | 82.97 | ± | 9.39 | <0.001 | <0.001 |
| eGFR | 107.09 | ± | 22.79 | 104.27 | ± | 21.00 | 100.24 | ± | 19.46 | 99.39 | ± | 21.37 | 94.70 | ± | 18.04 |  | <0.001 |
| DM events | 61 | 　 | 7.0% | 80 | 　 | 9.2% | 97 | 　 | 11.2% | 89 | 　 | 10.3% | 106 | 　 | 12.2% | 0.022 | 0.481 |
| DM incidence rate (per 1000 person years) | 7.88 |  |  | 10.21 |  |  | 11.00 |  |  | 12.30 |  |  | 12.34 |  |  | <0.001 | <0.001 |

Data are shown as mean ±SD and percentage (N%); \*P trend adjusted for age, sex and BMI

Supplemental Table 2 Adjusted hazard ratios of serum 25(OH)D with incident diabetes.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 25(OH)D levels (nmol/L) | n events |  | Model 1 |  | Model 2 |  |
| 　 | /n total |  | HR | 95% CI | 　 | HR | 95% CI | 　 |
| Quintile 1 | (<52.44) | 61/869 |  | 1.02 | (0.73-1.41) |  | 1.01 | (0.73-1.41) |  |
| Quintile 2 | (52,44 to <58.88) | 80/869 |  | 1.19 | (0.88-1.60) |  | 1.17 | (0.86-1.58) |  |
| Quintile 3 | (58.88 to <65.37) | 97/868 |  | 1.19 | (0.90-1.58) |  | 1.16 | (0.87-1.53) |  |
| Quintile 4 | (65.37 to <73.11) | 89/868 |  | 1.02 | (0.76-1.35) |  | 1.01 | (0.76-1.35) |  |
| Quintile 5 | (=>73.11) | 106/868 |  | 1.00 | Reference |  | 1.00 | Reference |  |
|  |  |  Ptrend value# |  | 0.591 |  | 0.711 |  |
|  |  |  |  |  |  |  |  |  |  |
| per 10nmol/L increase |  |  |  | 1.00 | (0.90-1.10) |  | 1.00 | (0.91-1.10) |  |
|  | 　 | P-value |  | 0.978 | 　 | 0.930 | 　 |
|  |  |  |  |  |  |  |  |  |  |
| Vitamin D status |  |  |  |  |  |  |  |  |  |
| deficiency | (<50) | 44/600 |  | 1.06 | (0.73-1.54) |  | 1.07 | (0.73-1.57) |  |
| insufficiency | (50 to <=75) | 299/3008 |  | 1.06 | (0.84-1.35) |  | 1.04 | (0.81-1.32) |  |
| sufficiency | (>75) | 90/734 |  | 1.00 | Reference |  | 1.00 | Reference |  |
| 　 | 　 | 　 |  | 　 | 　 | 　 | 　 |

Model 1: Adjusted for age, sex and BMI

Model 2: Model 1 further adjusted for lifestyle factors (smoking, drinking, physical activity, education levels), biomarkers of vitamin D (season, eGFR, serum calcium, serum albumin, serum phosphate, serum alkaline phosphatase, serum parathyroid hormone levels and femoral neck BMD T-score).

#p trend value: p value of HR across the quintiles using the median value of 25(OH)D in each quintile.

Supplemental Table 3 Serum 25(OH)D and serum calcium levels in stepwise Cox-regression for the risk of incident diabetes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|   |   | Model |   | Model 2 |   | Model 3 |
|   |  | HR | 95% CI | p-value |  | HR | 95% CI | p-value |  | HR | 95% CI | p-value |
| Serum 25(OH)D (nmol/L) |  |  |  |  |  |  |  |  |  |  |  |  |
| Quintile 1 |  | **0.65** | **(0.47 to 0.90)#** | **0.010** |  | 1.03 | (0.74 to 1.43) | 0.828 |  | 1.04 | (0.75 to 1.44) | 0.806 |
| Quintile 2 |  | 0.85 | (0.63 to 1.14) | 0.299 |  | 1.18 | (0.88 to 1.59) | 0.260 |  | 1.21 | (0.90 to 1.63) | 0.202 |
| Quintile 3 |  | 1.01 | (0.76 to 1.33) | 0.943 |  | 1.20 | (0.91 to 1.59) | 0.190 |  | 1.17 | (0.88 to 1.55) | 0.259 |
| Quintile 4 |  | 0.90 | (0.68 to 1.19) | 0.482 |  | 0.97 | (0.73 to 1.29) | 0.876 |  | 1.02 | (0.76 to 1.35) | 0.898 |
| Quintile 5 |  | 1 |  |  |  | 1 |  |  |  | 1 |  |  |
| Serum calcium level (mmol/L) |  | 8.90 | (2.94 to 26.88) | <0.001 |  | 8.96 | (2.94 to 25.45) | <0.001 |  | 8.58 | (2.89 to 25.42) | <0.001 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sex |  | - |  | 0.74 | (0.60 to 0.91) | 0.005 |  | 0.72 | (0.59 to 0.88) | 0.002 |
| Age (years) |  | - |  | 1.05 | (1.04 to 1.06) | <0.001 |  | 1.05 | (1.04 to 1.05) | <0.001 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| BMI (kg/m2) |   | - |   | - |   | 1.14 | (1.12 to 1.17) | <0.001 |

Model 1: adjusted for serum calcium level

Model 2: further adjusted for sex and age.

Model 3: further adjusted for BMI.

# Statistically significant (p<0.05)