Supplementary material

to

**Effect of waist circumference on the association between serum 25(OH)D and serum lipids: results from NHANES 2001-2006**

**Supplemental Table 1** Association between serum 25(OH)D and serum lipids in the total sample and stratified by WC category

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **25(OH)D category** | **N** | **Total cholesterol** | **LDL-C** | **HDL-C**‡ | **LDL-C/HDL-C ratio**‡ | **Triglycerides** |
| 4342 | [mmol/l] | [mmol/l] | [mmol/l] |  |  | [mmol/l] |
| **Total sample**\* |  |  | *β* | *P* | *β* | *P* | *β* | *P* | *β* | *P* | *GMR§* | *P* |
| <15 ng/ml | 820 | -0.06 | 0.43 | -0.03 | 0.71 | **-0.11** | **< 0.0001** | 0.14 | 0.05 | **1.10** | **0.006** |
| 15–<20 ng/ml | 808 | -0.10 | 0.07 | -0.07 | 0.18 | **-0.10** | **< 0.0001** | 0.11 | 0.05 | **1.08** | **0.014** |
| 20–<30 ng/ml | 1799 | -0.03 | 0.52 | -0.02 | 0.65 | **-0.06** | **0.0007** | 0.06 | 0.19 | **1.07** | **0.004** |
| >30 ng/ml | 915 | Ref. | Ref. | Ref. | Ref. | Ref. |
| **WC category** |  |  | *β* | *P* | *β* | *P* | *β* | *P* | *β* | *P* | *GMR§* | *P* |
| **Normal**†< 80 cm (f)< 94 cm (m) | <15 ng/ml | 174 | -0.21 | 0.08 | **-0.23** | **0.01** | -0.01 | 0.86 | -0.14 | 0.20 | 1.02 | 0.75 |
| 15–<20 ng/ml | 175 | -0.16 | 0.08 | **-0.19** | **0.04** | -0.04 | 0.28 | -0.10 | 0.37 | 1.07 | 0.24 |
| 20–<30 ng/ml | 507 | -0.04 | 0.58 | -0.08 | 0.16 | -0.02 | 0.54 | -0.07 | 0.20 | **1.08** | **0.04** |
| >30 ng/ml | 325 | Ref. | Ref. | Ref. | Ref. | Ref. |
| **Abdominally overweight**†80-<88 cm (f)94-<102 cm (m) | <15 ng/ml | 135 | -0.10 | 0.44 | -0.12 | 0.32 | -0.05 | 0.27 | -0.04 | 0.76 | 1.09 | 0.20 |
| 15–<20 ng/ml | 155 | **-0.30** | **0.004** | **-0.24** | **0.03** | -0.05 | 0.33 | 0.01 | 0.93 | 0.97 | 0.48 |
| 20–<30 ng/ml | 385 | -0.07 | 0.45 | -0.04 | 0.69 | -0.06 | 0.13 | 0.05 | 0.64 | 1.04 | 0.56 |
| >30 ng/ml | 194 | Ref. | Ref. | Ref. | Ref. | Ref. |
| **Abdominally****obese**†≥ 88 cm (f)≥ 102 cm (m) | <15 ng/ml | 511 | 0.009 | 0.94 | 0.08 | 0.49 | **-0.17** | **< 0.0001** | **0.32** | **0.001** | **1.14** | **0.004** |
| 15–<20 ng/ml | 478 | -0.03 | 0.72 | 0.03 | 0.69 | **-0.14** | **< 0.0001** | **0.25** | **0.001** | **1.11** | **0.02** |
| 20–<30 ng/ml | 907 | -0.03 | 0.65 | 0.01 | 0.90 | **-0.10** | **0.0002** | **0.14** | **0.03** | **1.08** | **0.04** |
| >30 ng/ml | 396 | Ref. | Ref. | Ref. | Ref. | Ref. |

25(OH)D, 25-hydroxyvitamin D. LDL-C, LDL cholesterol. HDL-C, HDL cholesterol. WC, waist circumference. (f), females. (m), males. GMR, geometric mean ratio.

Significant results are printed in **bold**

All models adjusted for age, sex, ethnicity, season of examination, physical activity, alcohol consumption, smoking status, level of education, kidney disease and intake of cholesterol lowering medication

\* adjusted for WC category

† stratified by WC category

‡ models additionally adjusted for survey cycle

§ Change in the ratio of the expected geometric means of the untransformed triglycerides. GMR = 1.09: compared to participants with serum 25(OH)D levels >30 ng/ml, the mean serum triglyceride level in participants with serum 25(OH)D levels <15 ng/ml is 9% higher.

**Supplemental Table 2** Association between serum 25(OH)D and serum lipids in the total sample and stratified by WC category - further adjusted for HOMA-IR

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **25(OH)D category** | **N** | **Total cholesterol**§ | **LDL-C**§ | **HDL-C**‡ | **LDL-C/HDL-C ratio**‡ | **Triglycerides** |
| 4342 | [mmol/l] | [mmol/l] | [mmol/l] |  |  | [mmol/l] |
| **Total sample**\* |  |  | *β* | *P* | *β* | *P* | *β* | *P* | *β* | *P* | *GMR||* | *P* |
| <15 ng/ml | 820 | -0.04 | 0.62 | 0.002 | 0.97 | **-0.09** | **0.0006** | 0.13 | 0.08 | 1.06 | 0.09 |
| 15–<20 ng/ml | 808 | -0.09 | 0.10 | -0.05 | 0.30 | **-0.09** | **0.0002** | 0.11 | 0.07 | 1.06 | 0.05 |
| 20–<30 ng/ml | 1799 | -0.03 | 0.58 | -0.01 | 0.76 | **-0.06** | **0.001** | 0.06 | 0.21 | **1.06** | **0.01** |
| >30 ng/ml | 915 | Ref. | Ref. | Ref. | Ref. | Ref. |
| **WC category** |  |  | *β* | *P* | *β* | *P* | *β* | *P* | *β* | *P* | *GMR||* | *P* |
| **Normal**†< 80 cm (f)< 94 cm (m) | <15 ng/ml | 174 | -0.21 | 0.08 | **-0.23** | **0.01** | 0.002 | 0.96 | -0.17 | 0.13 | 1.00 | 0.97 |
| 15–<20 ng/ml | 175 | -0.17 | 0.06 | **-0.19** | **0.03** | -0.03 | 0.43 | -0.12 | 0.27 | 1.04 | 0.44 |
| 20–<30 ng/ml | 507 | -0.04 | 0.54 | -0.08 | 0.15 | -0.01 | 0.73 | -0.08 | 0.13 | 1.06 | 0.09 |
| >30 ng/ml | 325 | Ref. | Ref. | Ref. | Ref. | Ref. |
| **Overweight**†80-<88 cm (f)94-<102 cm (m) | <15 ng/ml | 135 | -0.13 | 0.31 | -0.13 | 0.29 | -0.04 | 0.39 | -0.06 | 0.67 | 1.06 | 0.44 |
| 15–<20 ng/ml | 155 | **-0.32** | **0.003** | **-0.24** | **0.03** | -0.04 | 0.47 | -0.01 | 0.93 | 0.93 | 0.19 |
| 20–<30 ng/ml | 385 | -0.09 | 0.36 | -0.04 | 0.69 | -0.05 | 0.21 | 0.04 | 0.75 | 1.00 | 0.94 |
| >30 ng/ml | 194 | Ref. | Ref. | Ref. | Ref. | Ref. |
| **Obese**†≥ 88 cm (f)≥ 102 cm (m)  | <15 ng/ml | 511 | 0.06 | 0.62 | 0.14 | 0.26 | **-0.15** | **< 0.0001** | **0.32** | **0.001** | 1.10 | 0.06 |
| 15–<20 ng/ml | 478 | -0.001 | 0.99 | 0.06 | 0.42 | **-0.13** | **< 0.0001** | **0.25** | **0.001** | 1.09 | 0.06 |
| 20–<30 ng/ml | 907 | -0.02 | 0.78 | 0.02 | 0.75 | **-0.09** | **0.0004** | **0.14** | **0.03** | 1.08 | 0.05 |
| >30 ng/ml | 396 | Ref. | Ref. | Ref. | Ref. | Ref. |

HOMA-IR, homeostatic model assessment insulin resistance.25(OH)D, 25-hydroxyvitamin D. LDL-C, LDL cholesterol. HDL-C, HDL cholesterol. WC, waist circumference. (f), females. (m), males. GMR, geometric mean ratio.

Significant results are printed in **bold**

All models adjusted for age, sex, ethnicity, season of examination, physical activity, alcohol consumption, smoking status, level of education, kidney disease and intake of cholesterol lowering medication and HOMA-IR

\* adjusted for WC category

† stratified by WC category

‡ models additionally adjusted for survey cycle

§ models additionally adjusted for HOMA-IR2

|| Change in the ratio of the expected geometric means of the untransformed triglycerides. GMR = 1.06: compared to participants with serum 25(OH)D levels >30 ng/ml, the mean serum triglyceride level in participants with serum 25(OH)D levels <15 ng/ml is 6 % higher.

**Supplemental Fig. 1** Description of the study population



**Supplemental Fig. 2** Adjusted *β*-coefficients and 95% confidence intervals for the 25(OH)D categories from the interaction models on total cholesterol, LDL-C, HDL-C and the LDL-C/HDL-C ratio, with BMI used to operationalize obesity\*



Reference category: 25(OH)D ≥30 ng/ml

25(OH)D, 25-hydroxyvitamin D. LDL-C, LDL cholesterol. HDL-C, HDL cholesterol.

\* All models adjusted for age, sex, ethnicity, season of examination, physical activity, alcohol consumption, smoking status, level of education, kidney disease and intake of prescribed cholesterol lowering medication. HDL-C and LDL-C/HDL-C models additionally adjusted for survey cycle.

**Supplemental Fig. 2 (*continued*)** Adjusted geometric mean ratios and 95% confidence intervals for the 25(OH)D categories from the interaction model on triglycerides, with BMI used to operationalize obesity†



Reference category: 25(OH)D ≥30 ng/ml

25(OH)D, 25-hydroxyvitamin D.

† All models adjusted for age, sex, ethnicity, season of examination, physical activity, alcohol consumption, smoking status, level of education, kidney disease and intake of prescribed cholesterol lowering medication