**Online Supplementary Materials**

**Association of dietary oxidative balance score and sleep duration with the risk of mortality: prospective study in a representative US population**

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**Supplementary Figure 1.** Flow chart of study population

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**Supplementary Table 1.** The scheme of dietary oxidative balance score (DOBS) assignment

|  |  |
| --- | --- |
| DOBS components | Score assignment scheme |
| Pro-oxidant |  |
| Iron intake | 0 = fourth quartile, 1 = third quartile, 2 = second quartile, 3 = first quartile |
|  SFA intake | 0 = fourth quartile, 1 = third quartile, 2 = second quartile, 3 = first quartile |
|  n-6 PUFA intake | 0 = fourth quartile, 1 = third quartile, 2 = second quartile, 3 = first quartile |
| Antioxidant |  |
|  Vitamin C intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Vitamin E intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Selenium intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Alpha-carotene intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Beta-carotene intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Beta-cryptoxanthin intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Lycopene intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  Lutein + zeaxanthin intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |
|  n-3 PUFA intake | 0 = first quartile, 1 = second quartile, 2 = third quartile, 3 = fourth quartile |

Abbreviations: PUFA, polyunsaturated fatty acid. SFA, saturated fatty acid.

Each component is calculated as diet plus supplement when the supplement is available.

**Supplementary Table 2.** Comparison of food intake of participants in terms of DOBS quartiles, NHANES 2005-2010

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Food groups | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | *P* value |
| Fruits |  |  |  |  |  |
|  Total fruits and juices, cup eq. | 0.36 (0.01) | 0.73 (0.02) | 1.09 (0.02) | 1.70 (0.03) | <0.001 |
|  Citrus, melons, and berries, cup eq. | 0.04 (0.004) | 0.10 (0.01) | 0.19 (0.01) | 0.41 (0.02) | <0.001 |
|  Other fruits, cup eq. | 0.22 (0.01) | 0.38 (0.01) | 0.54 (0.02) | 0.76 (0.02) | <0.001 |
| Vegetables |  |  |  |  |  |
|  Total vegetables, cup eq. | 0.88 (0.01) | 1.30 (0.02) | 1.68 (0.02) | 2.30 (0.03) | <0.001 |
|  Dark green vegetables, cup eq. | 0.01 (0.002) | 0.05 (0.004) | 0.13 (0.005) | 0.30 (0.01) | <0.001 |
|  Red and orange vegetables, cup eq. | 0.16 (0.004) | 0.29 (0.01) | 0.43 (0.01) | 0.67 (0.01) | <0.001 |
|  Starchy vegetables, cup eq. | 0.43 (0.01) | 0.46 (0.01) | 0.47 (0.01) | 0.45 (0.01) | 0.077 |
|  Other vegetables, cup eq. | 0.27 (0.01) | 0.49 (0.02) | 0.65 (0.01) | 0.88 (0.02) | <0.001 |
| Grains |  |  |  |  |  |
|  Total grains, oz. eq. | 6.19 (0.07) | 6.66 (0.09) | 6.50 (0.07) | 6.38 (0.07) | 0.001 |
|  Refined grains, oz. eq. | 5.62 (0.07) | 5.98 (0.08) | 5.69 (0.07) | 5.33 (0.06) | <0.001 |
|  Whole grains, oz. eq. | 0.57 (0.02) | 0.68 (0.02) | 0.81 (0.02) | 1.04 (0.03) | <0.001 |
| Meats |  |  |  |  |  |
|  Total meat, oz. eq. | 4.35 (0.07) | 4.73 (0.06) | 4.96 (0.07) | 5.42 (0.09) | <0.001 |
|  Cured meat, oz. eq. | 1.15 (0.04) | 1.04 (0.04) | 1.05 (0.03) | 0.85 (0.02) | <0.001 |
|  Red meat, oz. eq. | 1.79 (0.04) | 1.77 (0.05) | 1.74 (0.04) | 1.54 (0.05) | <0.001 |
|  Poultry, oz. eq. | 1.22 (0.04) | 1.48 (0.04) | 1.56 (0.05) | 1.79 (0.05) | <0.001 |
|  Seafood, oz. eq. | 0.17 (0.02) | 0.43 (0.03) | 0.61 (0.03) | 1.22 (0.05) | <0.001 |
|  Organ meat, oz. eq. | 0.02 (0.004) | 0.02 (0.005) | 0.01 (0.002) | 0.01 (0.002) | 0.417 |
|  Eggs, oz. eq. | 0.36 (0.01) | 0.49 (0.01) | 0.55 (0.02) | 0.60 (0.02) | <0.001 |
| Dairies |  |  |  |  |  |
|  Total dairy, cup eq. | 1.58 (0.04) | 1.63 (0.04) | 1.60 (0.03) | 1.56 (0.03) | 0.22 |
|  Milk, cup eq. | 0.81 (0.03) | 0.85 (0.02) | 0.85 (0.02) | 0.87 (0.02) | 0.366 |
|  Yogurt, cup eq. | 0.03 (0.002) | 0.04 (0.003) | 0.06 (0.004) | 0.09 (0.004) | <0.001 |
|  Cheese, cup eq. | 0.73 (0.02) | 0.72 (0.02) | 0.68 (0.02) | 0.58 (0.02) | <0.001 |
| Others |  |  |  |  |  |
|  Legumes, oz. eq. | 1.11 (0.09) | 1.30 (0.07) | 1.35 (0.09) | 1.38 (0.07) | 0.069 |
|  Nuts, oz. eq. | 0.04 (0.01) | 0.05 (0.01) | 0.08 (0.01) | 0.10 (0.01) | <0.001 |
|  Soy products, oz. eq. | 0.46 (0.03) | 0.52 (0.03) | 0.68 (0.04) | 0.79 (0.04) | <0.001 |
|  Solid fats, grams | 40.62 (0.54) | 40.42 (0.60) | 38.46 (0.62) | 32.43 (0.54) | <0.001 |

Food intake is presented as weighted mean (SE), and *P* values were measured by general linear models.

**Supplementary Table 3.** Adjusted HRs (95% CIs) for the differences in DOBS and mortality stratified by sleep duration after further adjustment for red/cured meat intake and NSAIDs, NHANES 2005-2015

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mortality type/DOBS quartiles | Short sleep |  | Normal sleep |  | Long sleep | *P* interaction |
|  | HR (95% CI) | *P* value  |  | HR (95% CI) | *P* value  |  | HR (95% CI) | *P* value  |  |
| All-cause |  |  |  |  |  |  |  |  | 0.010  |
|  Continuous | 0.97 (0.95-0.995) | 0.016  |  | 0.98 (0.96-1.003) | 0.089  |  | 0.98 (0.94-1.01) | 0.206  |  |
|  Q1 | 1 (reference) | — |  | 1 (reference) | — |  | 1 (reference) | — |  |
|  Q2 | 0.87 (0.64-1.19) | 0.393  |  | 0.99 (0.77-1.27) | 0.943  |  | 0.91 (0.47-1.74) | 0.770  |  |
|  Q3 | 0.81 (0.60-1.09) | 0.167  |  | 0.90 (0.66-1.23) | 0.521  |  | 0.90 (0.52-1.58) | 0.721  |  |
|  Q4 | 0.68 (0.49-0.95) | 0.022  |  | 0.83 (0.62-1.11) | 0.209  |  | 0.69 (0.39-1.22) | 0.201  |  |
|  *P* trend | 0.020  |  |  | 0.181  |  |  | 0.131  |  |  |
| CVD |  |  |  |  |  |  |  |  | 0.063  |
|  Continuous | 0.99 (0.94-1.04) | 0.667  |  | 0.95 (0.92-0.99) | 0.004  |  | 1.01 (0.94-1.09) | 0.788  |  |
|  Q1 | 1 (reference) | — |  | 1 (reference) | — |  | 1 (reference) | — |  |
|  Q2 | 0.76 (0.41-1.41) | 0.383  |  | 0.92 (0.58-1.45) | 0.714  |  | 1.34 (0.24-7.55) | 0.744  |  |
|  Q3 | 0.89 (0.44-1.80) | 0.741  |  | 0.75 (0.43-1.31) | 0.312  |  | 1.23 (0.32-4.71) | 0.762  |  |
|  Q4 | 0.69 (0.32-1.49) | 0.348  |  | 0.53 (0.31-0.92) | 0.024  |  | 1.07 (0.24-4.80) | 0.933  |  |
|  *P* trend | 0.465  |  |  | 0.015  |  |  | 0.825  |  |  |
| Cancer |  |  |  |  |  |  |  |  | 0.416  |
|  Continuous | 0.97 (0.93-1.003) | 0.074  |  | 0.99 (0.96-1.03) | 0.580  |  | 1.00 (0.89-1.11) | 0.933  |  |
|  Q1 | 1 (reference) | — |  | 1 (reference) | — |  | 1 (reference) | — |  |
|  Q2 | 0.81 (0.38-1.74) | 0.596  |  | 0.97 (0.63-1.49) | 0.878  |  | 1.51 (0.36-6.25) | 0.570  |  |
|  Q3 | 0.66 (0.40-1.08) | 0.099  |  | 0.91 (0.61-1.36) | 0.648  |  | 1.33 (0.27-6.54) | 0.727  |  |
|  Q4 | 0.60 (0.34-1.06) | 0.079  |  | 0.90 (0.61-1.32) | 0.585  |  | 1.15 (0.19-6.79) | 0.880  |  |
|  *P* trend | 0.035  |  |  | 0.622  |  |  | 0.948  |  |  |

Adjustments included age, sex, race/ethnicity, education, household income, smoking status, alcohol drinking status, BMI category, physical activity, NCDs, prescription for diabetes, prescription for hypertension, depression, total energy intake, cholesterol intake and dietary supplement use, red/cured meat intake and NSAIDs.

**Supplementary Table 4.** Adjusted HRs (95% CIs) for the differences in DOBS and mortality stratified by sleep duration after further adjustment for sleep disorders, coffee consumption, and tea consumption, NHANES 2005-2015

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mortality type/DOBS quartiles | Short sleep |  | Normal sleep |  | Long sleep | *P* interaction |
|  | HR (95% CI) | *P* value  |  | HR (95% CI) | *P* value  |  | HR (95% CI) | *P* value  |  |
| All-cause |  |  |  |  |  |  |  |  | 0.011  |
|  Continuous | 0.97 (0.95-0.99) | 0.010  |  | 0.98 (0.96-1.004) | 0.105  |  | 0.98 (0.94-1.01) | 0.220  |  |
|  Q1 | 1 (reference) | — |  | 1 (reference) | — |  | 1 (reference) | — |  |
|  Q2 | 0.87 (0.63-1.19) | 0.379  |  | 1.00 (0.78-1.28) | 0.997  |  | 0.92 (0.47-1.77) | 0.795  |  |
|  Q3 | 0.80 (0.59-1.09) | 0.150  |  | 0.91 (0.66-1.24) | 0.550  |  | 0.93 (0.53-1.65) | 0.803  |  |
|  Q4 | 0.68 (0.49-0.94) | 0.020  |  | 0.84 (0.62-1.12) | 0.230  |  | 0.70 (0.39-1.24) | 0.221  |  |
|  *P* trend | 0.017  |  |  | 0.197  |  |  | 0.136  |  |  |
| CVD |  |  |  |  |  |  |  |  | 0.051  |
|  Continuous | 0.99 (0.94-1.04) | 0.591  |  | 0.95 (0.92-0.99) | 0.004  |  | 1.01 (0.94-1.09) | 0.851  |  |
|  Q1 | 1 (reference) | — |  | 1 (reference) | — |  | 1 (reference) | — |  |
|  Q2 | 0.76 (0.40-1.43) | 0.390  |  | 0.94 (0.60-1.47) | 0.790  |  | 1.21 (0.24-6.07) | 0.817  |  |
|  Q3 | 0.87 (0.43-1.76) | 0.700  |  | 0.76 (0.43-1.35) | 0.347  |  | 1.12 (0.31-4.02) | 0.858  |  |
|  Q4 | 0.68 (0.31-1.47) | 0.327  |  | 0.54 (0.31-0.94) | 0.028  |  | 0.96 (0.23-4.10) | 0.959  |  |
|  *P* trend | 0.428  |  |  | 0.018  |  |  | 0.746  |  |  |
| Cancer |  |  |  |  |  |  |  |  | 0.433  |
|  Continuous | 0.97 (0.93-1.004) | 0.080  |  | 0.99 (0.95-1.04) | 0.772  |  | 0.99 (0.90-1.10) | 0.898  |  |
|  Q1 | 1 (reference) | — |  | 1 (reference) | — |  | 1 (reference) | — |  |
|  Q2 | 0.81 (0.38-1.73) | 0.584  |  | 0.98 (0.58-1.65) | 0.928  |  | 1.57 (0.40-6.15) | 0.521  |  |
|  Q3 | 0.66 (0.39-1.11) | 0.118  |  | 0.94 (0.57-1.54) | 0.797  |  | 1.36 (0.30-6.10) | 0.692  |  |
|  Q4 | 0.59 (0.33-1.08) | 0.086  |  | 0.94 (0.57-1.56) | 0.803  |  | 1.13 (0.21-6.03) | 0.883  |  |
|  *P* trend | 0.042  |  |  | 0.785  |  |  | 0.911  |  |  |

Adjustments included age, sex, race/ethnicity, education, household income, smoking status, alcohol drinking status, BMI category, physical activity, NCDs, prescription for diabetes, prescription for hypertension, depression, total energy intake, cholesterol intake and dietary supplement use, sleep disorders, coffee consumption and tea consumption.

**Supplementary Table 5.** DOBS and the risk of mortality stratified by sleep duration, limiting participants with a follow-up time of >2years, NHANES 2005-2015

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mortality type/DOBS quartiles | Short sleep |  | Normal sleep |  | Long sleep | *P* interaction |
|  | cases/n | HR (95% CI) |  | cases/n | HR (95% CI) |  | cases/n | HR (95% CI) |  |
| All-cause |  |  |  |  |  |  |  |  | 0.020  |
|  Continuous | — | 0.97 (0.95-0.99) |  | — | 0.99 (0.97-1.005) |  | — | 0.98 (0.93-1.03) |  |
|  Q1 | 127/1549 | 1 (reference) |  | 148/1792 | 1 (reference) |  | 29/252 | 1 (reference) |  |
|  Q2 | 107/1500 | 0.79 (0.56-1.11) |  | 159/1976 | 1.03 (0.78-1.35) |  | 48/339 | 0.72 (0.36-1.44) |  |
|  Q3 | 134/1613 | 0.79 (0.57-1.11) |  | 212/2311 | 0.94 (0.68-1.30) |  | 39/266 | 0.79 (0.43-1.47) |  |
|  Q4 | 101/1385 | 0.58 (0.41-0.82) |  | 177/2310 | 0.87 (0.66-1.13) |  | 55/359 | 0.68 (0.34-1.34) |  |
|  *P* trend |  | 0.003  |  |  | 0.225  |  |  | 0.392  |  |
| CVD |  |  |  |  |  |  |  |  | 0.074  |
|  Continuous | — | 0.98 (0.92-1.04) |  | — | 0.95 (0.92-0.99) |  | — | 1.03 (0.94-1.13) |  |
|  Q1 | 18/1549 | 1 (reference) |  | 26/1792 | 1 (reference) |  | 4/252 | 1 (reference) |  |
|  Q2 | 17/1500 | 0.77 (0.37-1.63) |  | 28/1976 | 0.72 (0.38-1.35) |  | 9/339 | 1.05 (0.12-8.81) |  |
|  Q3 | 28/1613 | 0.93 (0.40-2.14) |  | 43/2311 | 0.69 (0.36-1.30) |  | 5/266 | 0.91 (0.19-4.27) |  |
|  Q4 | 14/1385 | 0.60 (0.22-1.62) |  | 23/2310 | 0.50 (0.29-0.88) |  | 14/359 | 1.48 (0.28-7.90) |  |
|  *P* trend |  | 0.411  |  |  | 0.038  |  |  | 0.490  |  |
| Cancer |  |  |  |  |  |  |  |  | 0.899  |
|  Continuous | — | 0.96 (0.92-1.01) |  | — | 1.00 (0.95-1.05) |  | — | 1.10 (0.95-1.26) |  |
|  Q1 | 24/1549 | 1 (reference) |  | 34/1792 | 1 (reference) |  | 7/252 | 1 (reference) |  |
|  Q2 | 23/1500 | 0.85 (0.36-1.96) |  | 33/1976 | 1.06 (0.57-1.98) |  | 5/339 | 0.95 (0.07-12.08) |  |
|  Q3 | 25/1613 | 0.70 (0.39-1.25) |  | 49/2311 | 1.05 (0.61-1.80) |  | 8/266 | 2.58 (0.29-23.21) |  |
|  Q4 | 25/1385 | 0.62 (0.30-1.28) |  | 45/2310 | 0.98 (0.55-1.74) |  | 10/359 | 2.42 (0.21-27.35) |  |
|  *P* trend |  | 0.126  |  |  | 0.894  |  |  | 0.249  |  |

Adjustments included age, sex, race/ethnicity, education, household income, smoking status, alcohol drinking status, BMI category, physical activity, NCDs, prescription for diabetes, prescription for hypertension, depression, total energy intake, cholesterol intake and dietary supplement use.

**Supplementary Table 6.** DOBS and the risk of mortality stratified by sleep duration, excluded those who used anxiolytics, sedatives, and hypnotics, NHANES 2005-2015

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mortality type/DOBS quartiles | Short sleep |  | Normal sleep |  | Long sleep | *P* interaction |
|  | cases/n | HR (95% CI) |  | cases/n | HR (95% CI) |  | cases/n | HR (95% CI) |  |
| All-cause |  |  |  |  |  |  |  |  | 0.007  |
|  Continuous | — | 0.97 (0.95-0.99) |  | — | 0.98 (0.96-1.004) |  | — | 0.97 (0.93-1.01) |  |
|  Q1 | 149/1507 | 1 (reference) |  | 174/1765 | 1 (reference) |  | 36/243 | 1 (reference) |  |
|  Q2 | 136/1470 | 0.90 (0.67-1.22) |  | 188/1941 | 0.99 (0.76-1.28) |  | 69/351 | 0.86 (0.42-1.74) |  |
|  Q3 | 150/1576 | 0.83 (0.62-1.11) |  | 240/2283 | 0.87 (0.63-1.20) |  | 50/269 | 0.87 (0.46-1.64) |  |
|  Q4 | 121/1360 | 0.68 (0.49-0.93) |  | 211/2295 | 0.82 (0.61-1.11) |  | 64/354 | 0.65 (0.34-1.24) |  |
|  *P* trend |  | 0.016  |  |  | 0.165  |  |  | 0.139  |  |
| CVD |  |  |  |  |  |  |  |  | 0.017  |
|  Continuous | — | 0.97 (0.92-1.03) |  | — | 0.95 (0.92-0.99) |  | — | 1.00 (0.93-1.08) |  |
|  Q1 | 25/1507 | 1 (reference) |  | 32/1765 | 1 (reference) |  | 5/243 | 1 (reference) |  |
|  Q2 | 20/1470 | 0.75 (0.40-1.40) |  | 33/1941 | 0.88 (0.56-1.38) |  | 14/351 | 1.23 (0.25-6.06) |  |
|  Q3 | 30/1576 | 0.78 (0.38-1.57) |  | 48/2283 | 0.66 (0.38-1.16) |  | 7/269 | 1.11 (0.32-3.92) |  |
|  Q4 | 17/1360 | 0.56 (0.23-1.36) |  | 29/2295 | 0.54 (0.30-0.94) |  | 13/354 | 0.93 (0.22-4.02) |  |
|  *P* trend |  | 0.239  |  |  | 0.020  |  |  | 0.691  |  |
| Cancer |  |  |  |  |  |  |  |  | 0.400  |
|  Continuous | — | 0.96 (0.93-1.001) |  | — | 0.99 (0.95-1.04) |  | — | 1.00 (0.89-1.11) |  |
|  Q1 | 33/1507 | 1 (reference) |  | 41/1765 | 1 (reference) |  | 10/243 | 1 (reference) |  |
|  Q2 | 34/1470 | 0.82 (0.39-1.73) |  | 39/1941 | 0.90 (0.52-1.57) |  | 13/351 | 1.34 (0.34-5.31) |  |
|  Q3 | 30/1576 | 0.65 (0.39-1.07) |  | 57/2283 | 0.92 (0.55-1.55) |  | 9/269 | 1.26 (0.26-6.13) |  |
|  Q4 | 31/1360 | 0.56 (0.31-1.01) |  | 53/2295 | 0.89 (0.52-1.50) |  | 12/354 | 1.13 (0.20-6.37) |  |
|  *P* trend |  | 0.023  |  |  | 0.714  |  |  | 0.998  |  |

Adjustments included age, sex, race/ethnicity, education, household income, smoking status, alcohol drinking status, BMI category, physical activity, NCDs, prescription for diabetes, prescription for hypertension, depression, total energy intake, cholesterol intake and dietary supplement use.