**Supplementary Table 1: Associations between individual PNT in quartiles and eGFR, and risk of CKD.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Items** | **Non-adjusted β (95% CI)** | ***P-*value** | **Adjusted β (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)‡** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |  |  |  |  |
| Perchlorate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | −1.33 (−2.79, 0.12) | 0.076  | −1.85 (−3.19, −0.50) | 0.009  | 1.10 (0.91, 1.33) | 0.341  |
| Quartile 3 | −0.52 (−2.01, 0.97) | 0.498  | −2.40 (−3.76, −1.05) | 0.001  | 1.01 (0.85, 1.18) | 0.940  |
| Quartile 4 | 1.54 (0.02, 3.06) | 0.050  | −1.51 (−2.72, −0.30) | 0.016  | 0.97 (0.80, 1.16) | 0.729  |
| *P*-trend |  | 0.030  |  | 0.011  |  | 0.520  |
| Nitrate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 4.96 (3.48, 6.45) | <0.001 | 1.42 (0.24, 2.61) | 0.021  | 0.89 (0.75, 1.05) | 0.167  |
| Quartile 3 | 8.35 (6.75, 9.96) | <0.001 | 2.02 (0.97, 3.08) | <0.001 | 0.80 (0.67, 0.95) | 0.014  |
| Quartile 4 | 8.35 (6.93, 9.77) | <0.001 | 1.01 (−0.14, 2.16) | 0.090  | 0.66 (0.54, 0.80) | <0.001 |
| *P*-trend |  | <0.001 |  | 0.060  |  | <0.001 |
| Thiocyanate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 4.06 (2.46, 5.67) | <0.001 | 2.03 (0.81, 3.26) | 0.002  | 0.88 (0.77, 1.01) | 0.070  |
| Quartile 3 | 6.52 (4.99, 8.05) | <0.001 | 1.93 (0.72, 3.15) | 0.003  | 0.71 (0.58, 0.86) | 0.001  |
| Quartile 4 | 9.97 (8.44, 11.50) | <0.001 | 2.82 (1.58, 4.07) | <0.001 | 0.75 (0.63, 0.88) | 0.001  |
| *P*-trend |  | <0.001 |  | <0.001 |  | <0.001 |
| **PNT-new\*** |  |  |  |  |  |  |
| Perchlorate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 0.04 (−1.62, 1.71) | 0.959  | −0.74 (−2.06, 0.59) | 0.280  | 0.86 (0.72, 1.02) | 0.082  |
| Quartile 3 | 0.29 (−1.38, 1.96) | 0.734  | −1.24 (−2.48, 0.0006) | 0.054  | 1.04 (0.89, 1.22) | 0.630  |
| Quartile 4 | 3.09 (1.44, 4.74) | <0.001 | −0.17 (−1.46, 1.12) | 0.796  | 0.98 (0.82, 1.17) | 0.852  |
| *P*-trend |  | <0.001 |  | 0.648  |  | 0.610  |
| Nitrate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 9.57 (8.07, 11.06) | <0.001 | 1.76 (0.52, 3.00) | 0.007  | 0.68 (0.56, 0.83) | <0.001 |
| Quartile 3 | 12.03 (10.28, 13.77) | <0.001 | 2.33 (0.89, 3.78) | 0.002  | 0.70 (0.59, 0.83) | <0.001 |
| Quartile 4 | 12.26 (10.65, 13.88) | <0.001 | 3.16 (1.77, 4.54) | <0.001 | 0.69 (0.56, 0.83) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |  | <0.001 |
| Thiocyanate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 4.50 (2.92, 6.08) | <0.001 | 1.37 (0.12, 2.63) | 0.034  | 0.80 (0.67, 0.96) | 0.022  |
| Quartile 3 | 7.28 (5.59, 8.98) | <0.001 | 2.70 (1.43, 3.98) | <0.001 | 0.73 (0.62, 0.87) | 0.001  |
| Quartile 4 | 10.62 (8.93, 12.32) | <0.001 | 3.50 (2.09, 4.90) | <0.001 | 0.74 (0.62, 0.88) | 0.001  |
| *P*-trend |  | <0.001 |  | <0.001 |  | <0.001 |
| **PNT-traditional†** |  |  |  |  |  |  |
| Perchlorate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | −2.07 (−3.57, −0.57) | 0.008  | 1.46 (0.25, 2.67) | 0.021  | 0.94 (0.78, 1.13) | 0.507  |
| Quartile 3 | −3.06 (−4.50, −1.61) | <0.001 | 3.17 (1.91, 4.44) | <0.001 | 0.91 (0.76, 1.09) | 0.311  |
| Quartile 4 | −1.92 (−3.42, −0.42) | 0.014  | 5.88 (4.64, 7.11) | <0.001 | 0.85 (0.71, 1.02) | 0.088  |
| *P*-trend |  | 0.011  |  | <0.001 |  | 0.089  |
| Nitrate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 6.88 (5.26, 8.50) | <0.001 | 5.92 (4.65, 7.18) | <0.001 | 0.55 (0.46, 0.65) | <0.001 |
| Quartile 3 | 6.36 (4.77, 7.94) | <0.001 | 8.66 (7.46, 9.86) | <0.001 | 0.52 (0.44, 0.61) | <0.001 |
| Quartile 4 | 5.68 (3.92, 7.44) | <0.001 | 11.81 (10.34, 13.28) | <0.001 | 0.45 (0.38, 0.53) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |  | <0.001 |
| Thiocyanate |  |  |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  | Ref. |  |
| Quartile 2 | 3.13 (1.57, 4.68) | <0.001 | 3.31 (2.20, 4.42) | <0.001 | 0.67 (0.57, 0.78) | <0.001 |
| Quartile 3 | 4.43 (2.85, 6.00) | <0.001 | 6.20 (5.04, 7.37) | <0.001 | 0.64 (0.54, 0.75) | <0.001 |
| Quartile 4 | 7.66 (5.98, 9.34) | <0.001 | 7.65 (6.31, 8.90) | <0.001 | 0.59 (0.50, 0.69) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |  | <0.001 |

BMI: Body mass index; CI: Confidence interval; CKD: Chronic kidney disease; eGFR: Estimated glomerular filtration rate; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, BMI, physical activity, and cigarettes per day.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

‡OR and 95% CIs for CKD in logistic regressions.

**Supplementary Table 2: Associations between individual PNT in quartiles and ACR.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Items** | **Non-adjusted β (95% CI)** | ***P*-value** | **Adjusted β (95% CI)** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |  |  |
| Perchlorate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | 0.01 (−0.06, 0.08) | 0.701  | 0.004 (−0.06, 0.07) | 0.900  |
| Quartile 3 | −0.09 (−0.14, −0.04) | 0.001  | −0.08 (−0.13, −0.03) | 0.003  |
| Quartile 4 | −0.12 (−0.18, −0.07) | <0.001 | −0.08 (−0.14, −0.03) | 0.003  |
| *P*-trend |  | <0.001 |  | <0.001 |
| Nitrate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.07 (−0.13, −0.02) | 0.012  | −0.03 (−0.08, 0.03) | 0.310  |
| Quartile 3 | −0.18 (−0.24, −0.13) | <0.001 | −0.09 (−0.15, −0.04) | 0.001  |
| Quartile 4 | −0.24 (−0.30, −0.19) | <0.001 | −0.13 (−0.18, −0.07) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |
| Thiocyanate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.11 (−0.18, −0.04) | 0.002  | −0.06 (−0.12, 0.01) | 0.118  |
| Quartile 3 | −0.24 (−0.30, −0.18) | <0.001 | −0.13 (−0.20, −0.06) | <0.001 |
| Quartile 4 | −0.19 (−0.25, −0.14) | <0.001 | −0.07 (−0.14, −0.003) | 0.044  |
| *P*-trend |  | <0.001 |  | 0.008  |
| **PNT-new\*** |  |  |  |  |
| Perchlorate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.14 (−0.21, −0.08) | <0.001 | −0.10 (−0.16, −0.04) | 0.001  |
| Quartile 3 | −0.16 (−0.22, −0.11) | <0.001 | −0.11 (−0.16, −0.05) | <0.001 |
| Quartile 4 | −0.19 (−0.25, −0.13) | <0.001 | −0.11 (−0.17, −0.05) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |
| Nitrate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.27 (−0.33, −0.22) | <0.001 | −0.12 (−0.18, −0.06) | <0.001 |
| Quartile 3 | −0.31 (−0.36, −0.26) | <0.001 | −0.13 (−0.18, −0.07) | <0.001 |
| Quartile 4 | −0.32 (−0.38, −0.27) | <0.001 | −0.14 (−0.19, −0.08) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |
| Thiocyanate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.23 (−0.29, −0.18) | <0.001 | −0.14 (−0.19, −0.08) | <0.001 |
| Quartile 3 | −0.28 (−0.34, −0.22) | <0.001 | −0.13 (−0.19, −0.07) | <0.001 |
| Quartile 4 | −0.24 (−0.29, −0.18) | <0.001 | −0.09 (−0.15, −0.04) | 0.002  |
| *P*-trend |  | <0.001 |  | 0.010  |
| **PNT-traditional†** |  |  |  |  |
| Perchlorate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.03 (−0.09, 0.02) | 0.233  | −0.06 (−0.11, −0.009) | 0.025  |
| Quartile 3 | −0.02 (−0.07, 0.04) | 0.533  | −0.09 (−0.14, −0.04) | 0.001  |
| Quartile 4 | 0.03 (−0.03, 0.09) | 0.341  | −0.08 (−0.13, −0.02) | 0.012  |
| *P*-trend |  | 0.250  |  | 0.012  |
| Nitrate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.17 (−0.24, −0.11) | <0.001 | −0.15 (−0.21, −0.09) | <0.001 |
| Quartile 3 | −0.12 (−0.18, −0.06) | <0.001 | −0.13 (−0.18, −0.07) | <0.001 |
| Quartile 4 | −0.09 (−0.15, −0.03) | 0.003  | −0.15 (−0.20, −0.09) | <0.001 |
| *P*-trend |  | <0.001 |  | <0.001 |
| Thiocyanate |  |  |  |  |
| Quartile 1 | Ref. |  | Ref. |  |
| Quartile 2 | −0.19 (−0.25, −0.13) | <0.001 | −0.15 (−0.21, −0.09) | <0.001 |
| Quartile 3 | −0.18 (−0.24, −0.12) | <0.001 | −0.13 (−0.19, −0.08) | <0.001 |
| Quartile 4 | −0.14 (−0.20, −0.09) | <0.001 | −0.11 (−0.17, −0.05) | 0.001  |
| *P*-trend |  | <0.001 |  | 0.003  |

ACR: Albumin-to-creatinine ratio; BMI: Body mass index; CI: Confidence interval; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT and ACR were ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, BMI, physical activity, and cigarettes per day.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

**Supplementary Table 3: Subgroups analysis for the associations between urinary PNT and the risk of CKD.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subgroups** | **Perchlorate** | **Nitrate** | **Thiocyanate** |
| **Adjusted OR (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)** | ***P*-value** |
| Age (years) |  |  |  |  |  |  |
| 20–39 | 1.02 (0.88, 1.18) | 0.836 | 1.18 (0.97, 1.43) | 0.111 | 0.99 (0.90, 13.10) | 0.866 |
| 40–59 | 0.98 (0.88, 1.09) | 0.694 | 0.78 (0.66, 0.93) | 0.007 | 0.87 (0.78, 0.97) | 0.014 |
| 60–79 | 1.00 (0.93, 1.08) | 0.946 | 0.70 (0.63, 0.77) | <0.001 | 0.79 (0.72, 0.86) | <0.001 |
| Sex |  |  |  |  |  |  |
| Male | 0.93 (0.85, 1.03) | 0.161 | 0.72 (0.63, 0.81) | <0.001 | 0.88 (0.81, 0.95) | 0.003 |
| Female | 1.03 (0.95, 1.12) | 0.439 | 0.87 (0.80, 0.96) | 0.005 | 0.89 (0.83, 0.96) | 0.004 |
| Race/ethnicity (%) |  |  |  |  |  |  |
| Mexican American | 0.91 (0.79, 1.06) | 0.221 | 0.72 (0.63, 0.83) | <0.001 | 0.95 (0.84, 1.08) | 0.426 |
| Other Hispanic | 1.03 (0.83, 1.27) | 0.806 | 1.01 (0.82, 1.26) | 0.893 | 1.02 (0.84, 1.24) | 0.840  |
| Non-Hispanic White | 1.03 (0.95, 1.13) | 0.454 | 0.84 (0.75, 0.93) | 0.001 | 0.85 (0.79, 0.93) | <0.001 |
| Non-Hispanic Black | 0.88 (0.78, 0.99) | 0.042 | 0.72 (0.64, 0.81) | <0.001 | 0.93 (0.86, 1.01) | 0.089 |
| Other race-including multi-racial | 0.89 (0.72, 1.10) | 0.271 | 0.74 (0.53, 1.03) | 0.077 | 0.92 (0.76, 1.13) | 0.444 |
| Family income-to-poverty ratio |  |  |  |  |  |  |
| ≤1.85 | 0.96 (0.88, 1.04) | 0.335 | 0.82 (0.74, 0.91) | <0.001 | 0.91 (0.85, 0.97) | 0.004 |
| 1.85–3.50 | 0.99 (0.87, 1.12) | 0.867 | 0.78 (0.67, 0.90) | 0.001 | 0.91 (0.81, 1.02) | 0.105 |
| >3.50 | 1.04 (0.91, 1.18) | 0.567 | 0.83 (0.70, 0.97) | 0.021 | 0.83 (0.75, 0.93) | 0.002 |
| Education levels (%) |  |  |  |  |  |  |
| <9th grade | 0.89 (0.74, 1.06) | 0.182 | 0.75 (0.60, 0.96) | 0.022 | 0.79 (0.67, 0.92) | 0.004 |
| 9th–12th grade or equivalent | 0.99 (0.87, 1.12) | 0.862 | 0.83 (0.72, 0.96) | 0.012 | 0.94 (0.85, 1.03) | 0.162 |
| College or above | 1.02 (0.93, 1.11) | 0.735 | 0.82 (0.73, 0.91) | <0.001 | 0.88 (0.80, 0.96) | 0.008 |
| BMI (kg/m2) |  |  |  |  |  |  |
| <25 | 1.01 (0.89, 1.14) | 0.930  | 0.92 (0.81, 1.05) | 0.239 | 0.87 (0.79, 0.95) | 0.003 |
| 25–30 | 1.01 (0.88, 1.17) | 0.839 | 0.80 (0.69, 0.94) | 0.007 | 0.89 (0.80, 1.00) | 0.055 |
| ≥30 | 0.97 (0.87, 1.09) | 0.611 | 0.74 (0.66, 0.84) | <0.001 | 0.88 (0.81, 0.96) | 0.006 |
| Smoking status |  |  |  |  |  |  |
| Non-smokers | 0.99 (0.90, 1.08) | 0.764 | 0.83 (0.74, 0.93) | 0.002 | 0.82 (0.75, 0.91) | <0.001 |
| Smokers | 0.99 (0.91, 1.09) | 0.975 | 0.79 (0.71, 0.89) | <0.001 | 0.92 (0.85, 0.99) | 0.045 |
| LTPA\* |  |  |  |  |  |  |
| Below median (non-active) | 0.97 (0.88, 1.06) | 0.462 | 0.78 (0.69, 0.87) | <0.001 | 0.87 (0.82, 0.93) | <0.001 |
| Above median (active) | 1.02 (0.92, 1.12) | 0.732 | 0.86 (0.75, 0.99) | 0.038 | 0.90 (0.81, 1.01) | 0.070  |
| Alcohol consumption |  |  |  |  |  |  |
| Low (below median) | 1.03 (0.93, 1.14) | 0.591 | 0.88 (0.79, 0.99) | 0.029 | 0.88 (0.82, 0.95) | 0.002 |
| High (above median) | 0.96 (0.87, 1.06) | 0.394 | 0.75 (0.67, 0.85) | <0.001 | 0.89 (0.82, 0.96) | 0.006 |
| Diet quality (HEI-2015) |  |  |  |  |  |  |
| Low (below median) | 1.01 (0.92, 1.10) | 0.874 | 0.79 (0.71, 0.87) | <0.001 | 0.86 (0.81, 0.93) | <0.001 |
| High (above median) | 0.98 (0.88, 1.08) | 0.640  | 0.85 (0.75, 0.95) | 0.005 | 0.91 (0.82, 1.00) | 0.065 |
| Take medicine |  |  |  |  |  |  |
| No | 0.98 (0.88, 1.10) | 0.772 | 1.02 (0.85, 1.21) | 0.851 | 0.96 (0.87, 1.05) | 0.371 |
| Yes | 0.99 (0.92, 1.08) | 0.887 | 0.77 (0.70, 0.84) | <0.001 | 0.87 (0.82, 0.93) | <0.001 |

BMI: Body mass index; CI: Confidence interval; CKD: Chronic kidney disease; HEI: Healthy eating index; LTPA: Leisure-time physical activity; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, BMI, physical activity, and cigarettes per day.

**Supplementary Table 4: Subgroups analysis for the associations between urinary PNT after covariate-adjusted creatinine standardization and the risk of CKD.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subgroups** | **Perchlorate** | **Nitrate** | **Thiocyanate** |
| **Adjusted OR (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)** | ***P*-value** |
| Age (years) |  |  |  |  |  |  |
| 20–39 | 0.94 (0.81, 1.10) | 0.456 | 1.18 (0.88, 1.57) | 0.268 | 0.95 (0.84, 1.06) | 0.332 |
| 40–59 | 1.03 (0.87, 1.22) | 0.726 | 0.68 (0.55, 0.85) | 0.001 | 0.89 (0.81, 0.98) | 0.023 |
| 60–79 | 1.01 (0.92, 1.12) | 0.789 | 0.60 (0.52, 0.69) | <0.001 | 0.81 (0.74, 0.88) | <0.001 |
| Sex |  |  |  |  |  |  |
| Male | 1.02 (0.89, 1.17) | 0.747 | 0.68 (0.55, 0.84) | <0.001 | 0.93 (0.85, 1.01) | 0.086 |
| Female | 1.01 (0.92, 1.12) | 0.801 | 0.76 (0.68, 0.86) | <0.001 | 0.88 (0.81, 0.94) | 0.001 |
| Race/ethnicity (%) |  |  |  |  |  |  |
| Mexican American | 1.02 (0.87, 1.19) | 0.842 | 0.71 (0.57, 0.88) | 0.002 | 1.02 (0.88, 1.19) | 0.75 |
| Other Hispanic | 0.97 (0.71, 1.30) | 0.816 | 0.91 (0.65, 1.27) | 0.574 | 0.98 (0.80, 1.20) | 0.836 |
| Non-Hispanic White | 1.06 (0.93, 1.20) | 0.403 | 0.75 (0.66, 0.85) | <0.001 | 0.86 (0.80, 0.92) | <0.001 |
| Non-Hispanic Black | 0.93 (0.82, 1.05) | 0.242 | 0.68 (0.58, 0.79) | <0.001 | 0.96 (0.89, 1.04) | 0.353 |
| Other race-including multi-racial | 0.89 (0.69, 1.13) | 0.334 | 0.61 (0.43, 0.88) | 0.009 | 0.94 (0.78, 1.13) | 0.495 |
| Family income-to-poverty ratio |  |  |  |  |  |  |
| ≤1.85 | 0.91 (0.82, 1.00) | 0.051 | 0.67 (0.59, 0.77) | <0.001 | 0.89 (0.84, 0.95) | <0.001 |
| >1.85 to ≤3.50 | 1.10 (0.95, 1.27) | 0.205 | 0.79 (0.66, 0.94) | 0.01 | 0.96 (0.86, 1.07) | 0.436 |
| >3.50 | 1.09 (0.91, 1.31) | 0.353 | 0.74 (0.60, 0.91) | 0.006 | 0.83 (0.74, 0.94) | 0.004 |
| Education levels (%) |  |  |  |  |  |  |
| <9th grade | 0.86 (0.67, 1.09) | 0.222 | 0.64 (0.50, 0.82) | 0.001 | 0.79 (0.68, 0.92) | 0.003 |
| 9th–12th grade or equivalent | 1.00 (0.85, 1.17) | 0.978 | 0.74 (0.62, 0.88) | 0.001 | 0.94 (0.87, 1.02) | 0.159 |
| College or above | 1.06 (0.95, 1.18) | 0.284 | 0.75 (0.66, 0.86) | <0.001 | 0.89 (0.81, 0.97) | 0.014 |
| BMI (kg/m2) |  |  |  |  |  |  |
| <25 | 0.96 (0.84, 1.11) | 0.578 | 0.83 (0.70, 0.99) | 0.035 | 0.86 (0.78, 0.94) | 0.002 |
| ≥25 to <30 | 1.09 (0.94, 1.27) | 0.247 | 0.76 (0.63, 0.92) | 0.006 | 0.92 (0.82, 1.03) | 0.172 |
| ≥30 | 1.03 (0.90, 1.17) | 0.717 | 0.67 (0.57, 0.79) | <0.001 | 0.91 (0.84, 0.99) | 0.034 |
| Smoking status |  |  |  |  |  |  |
| Non-smokers | 0.99 (0.88, 1.13) | 0.982 | 0.76 (0.65, 0.89) | 0.001 | 0.82 (0.76, 0.90) | <0.001 |
| Smokers | 1.03 (0.93, 1.14) | 0.556 | 0.71 (0.61, 0.81) | <0.001 | 0.94 (0.87, 1.01) | 0.102 |
| LTPA\* |  |  |  |  |  |  |
| Below median (non-active) | 1.06 (0.94, 1.20) | 0.37 | 0.77 (0.66, 0.89) | 0.001 | 0.91 (0.85, 0.98) | 0.018 |
| Above median (active) | 0.96 (0.85, 1.10) | 0.568 | 0.70 (0.61, 0.82) | <0.001 | 0.87 (0.79, 0.96) | 0.007 |
| Alcohol consumption |  |  |  |  |  |  |
| Low (below median) | 1.02 (0.91, 1.13) | 0.777 | 0.78 (0.69, 0.89) | <0.001 | 0.87 (0.81, 0.94) | 0.001 |
| High (above median) | 1.01 (0.89, 1.15) | 0.886 | 0.69 (0.59, 0.79) | <0.001 | 0.92 (0.85, 0.99) | 0.039 |
| Diet quality (HEI-2015) |  |  |  |  |  |  |
| Low (below median) | 1.05 (0.93, 1.18) | 0.422 | 0.71 (0.63, 0.80) | <0.001 | 0.88 (0.82, 0.94) | <0.001 |
| High (above median) | 0.98 (0.86, 1.10) | 0.699 | 0.76 (0.65, 0.89) | 0.001 | 0.91 (0.83, 1.00) | 0.049 |
| Take medicine |  |  |  |  |  |  |
| No | 0.98 (0.86, 1.12) | 0.755 | 1.04 (0.81, 1.34) | 0.758 | 0.96 (0.87, 1.06) | 0.379 |
| Yes | 1.02 (0.92, 1.14) | 0.686 | 0.68 (0.61, 0.77) | <0.001 | 0.89 (0.83, 0.94) | <0.001 |

BMI: Body mass index; CI: Confidence interval; CKD: Chronic kidney disease; HEI: Healthy eating index; LTPA: Leisure-time physical activity; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, BMI, physical activity, and cigarettes per day.

**Supplementary Table 5: Subgroups analysis for the associations between urinary PNT after traditional creatinine adjustment and the risk of CKD.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subgroups** | **Perchlorate** | **Nitrate** | **Thiocyanate** |
| **Adjusted OR (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)** | ***P*-value** |
| Age (years) |  |  |  |  |  |  |
| 20–39 | 0.94 (0.80, 1.10) | 0.438 | 1.15 (0.86, 1.55) | 0.354 | 0.94 (0.84, 1.05) | 0.296 |
| 40–59 | 0.98 (0.83, 1.15) | 0.817 | 0.64 (0.51, 0.80) | <0.001 | 0.87 (0.79, 0.96) | 0.009 |
| 60–79 | 0.92 (0.83, 1.02) | 0.112 | 0.53 (0.46, 0.62) | <0.001 | 0.77 (0.71, 0.84) | <0.001 |
| Sex |  |  |  |  |  |  |
| Male | 0.96 (0.84, 1.10) | 0.587 | 0.62 (0.51, 0.77) | <0.001 | 0.90 (0.83, 0.99) | 0.027 |
| Female | 0.89 (0.80, 0.99) | 0.028 | 0.65 (0.57, 0.73) | <0.001 | 0.82 (0.76, 0.89) | <0.001 |
| Race/ethnicity (%) |  |  |  |  |  |  |
| Mexican American | 0.97 (0.82, 1.14) | 0.695 | 0.67 (0.54, 0.83) | <0.001 | 0.996 (0.86, 1.16) | 0.96 |
| Other Hispanic | 0.92 (0.68, 1.24) | 0.583 | 0.84 (0.61, 1.16) | 0.293 | 0.95 (0.77, 1.17) | 0.643 |
| Non-Hispanic White | 0.93 (0.81, 1.06) | 0.262 | 0.63 (0.55, 0.72) | <0.001 | 0.81 (0.75, 0.87) | <0.001 |
| Non-Hispanic Black | 0.89 (0.78, 1.01) | 0.066 | 0.63 (0.54, 0.74) | <0.001 | 0.94 (0.88, 1.02) | 0.145 |
| Other race-including multi-racial | 0.86 (0.68, 1.08) | 0.203 | 0.59 (0.42, 0.84) | 0.004 | 0.92 (0.77, 1.10) | 0.358 |
| Family income-to-poverty ratio |  |  |  |  |  |  |
| ≤1.85 | 0.84 (0.76, 0.92) | 0.001 | 0.60 (0.52, 0.69) | <0.001 | 0.86 (0.81, 0.92) | <0.001 |
| >1.85 to ≤3.50 | 0.99 (0.86, 1.16) | 0.956 | 0.71 (0.59, 0.84) | <0.001 | 0.92 (0.82, 1.03) | 0.143 |
| >3.50 | 0.96 (0.80, 1.16) | 0.696 | 0.62 (0.50, 0.77) | <0.001 | 0.78 (0.69, 0.89) | <0.001 |
| Education levels (%) |  |  |  |  |  |  |
| <9th grade | 0.78 (0.6, 1.00) | 0.056 | 0.56 (0.43, 0.73) | <0.001 | 0.76 (0.65, 0.88) | <0.001 |
| 9th–12th grade or equivalent | 0.89 (0.75, 1.05) | 0.170  | 0.62 (0.52, 0.75) | <0.001 | 0.89 (0.82, 0.97) | 0.011 |
| College or above | 0.97 (0.87, 1.08) | 0.595 | 0.68 (0.59, 0.77) | <0.001 | 0.86 (0.78, 0.94) | 0.001 |
| BMI (kg/m2) |  |  |  |  |  |  |
| <25 | 0.88 (0.76, 1.01) | 0.081 | 0.74 (0.63, 0.88) | 0.001 | 0.83 (0.75, 0.91) | <0.001 |
| ≥25 to <30 | 0.97 (0.83, 1.13) | 0.685 | 0.64 (0.52, 0.77) | <0.001 | 0.87 (0.78, 0.97) | 0.015 |
| ≥30 | 0.91 (0.79, 1.04) | 0.17 | 0.56 (0.47, 0.67) | <0.001 | 0.86 (0.79, 0.94) | 0.001 |
| Smoking status |  |  |  |  |  |  |
| Non-smokers | 0.90 (0.80, 1.03) | 0.122 | 0.67 (0.57, 0.78) | <0.001 | 0.78 (0.71, 0.85) | <0.001 |
| Smokers | 0.94 (0.84, 1.04) | 0.219 | 0.62 (0.54, 0.71) | <0.001 | 0.90 (0.83, 0.98) | 0.013 |
| LTPA\* |  |  |  |  |  |  |
| Below median (non-active) | 0.95 (0.84, 1.08) | 0.43 | 0.67 (0.57, 0.77) | <0.001 | 0.87 (0.81, 0.94) | <0.001 |
| Above median (active) | 0.88 (0.77, 1.01) | 0.064 | 0.62 (0.54, 0.72) | <0.001 | 0.84 (0.76, 0.92) | 0.001 |
| Alcohol consumption |  |  |  |  |  |  |
| Low (below median) | 0.92 (0.83, 1.03) | 0.141 | 0.69 (0.61, 0.79) | <0.001 | 0.84 (0.77, 0.91) | <0.001 |
| High (above median) | 0.91 (0.80, 1.04) | 0.172 | 0.59 (0.51, 0.69) | <0.001 | 0.88 (0.81, 0.95) | 0.002 |
| Diet quality (HEI-2015) |  |  |  |  |  |  |
| Low (below median) | 0.95 (0.84, 1.08) | 0.445 | 0.62 (0.55, 0.71) | <0.001 | 0.84 (0.79, 0.90) | <0.001 |
| High (above median) | 0.88 (0.78, 1.00) | 0.050  | 0.67 (0.57, 0.78) | <0.001 | 0.87 (0.80, 0.95) | 0.004 |
| Take medicine |  |  |  |  |  |  |
| No | 0.95 (0.83, 1.09) | 0.474 | 0.98 (0.76, 1.27) | 0.905 | 0.94 (0.85, 1.04) | 0.251 |
| Yes | 0.91 (0.81, 1.01) | 0.077 | 0.58 (0.52, 0.66) | <0.001 | 0.84 (0.79, 0.89) | <0.001 |

BMI: Body mass index; CI: Confidence interval; CKD: Chronic kidney disease; HEI: Healthy eating index; LTPA: Leisure-time physical activity; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, BMI, physical activity, and cigarettes per day.

**Supplementary Table 6: Associations between individual PNT and eGFR, and risk of CKD in the first sensitivity analysis (*N* = 11,066).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Multivariable regression** | **Adjusted β (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)‡** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |  |  |
| Perchlorate | −0.61 (−1.12, −0.09) | 0.025 | 1.00 (0.93, 1.07) | 0.950  |
| Nitrate | 0.45 (−0.21, 1.10) | 0.187 | 0.83 (0.76, 0.91) | <0.001 |
| Thiocyanate | 0.92 (0.52, 1.32) | <0.001 | 0.90 (0.84, 0.96) | 0.003 |
| **PNT-new\*** |  |  |  |  |
| Perchlorate | −0.29 (−0.96, 0.37) | 0.388 | 1.02 (0.92, 1.12) | 0.726 |
| Nitrate | 1.96 (0.97, 2.95) | <0.001 | 0.75 (0.67, 0.84) | <0.001 |
| Thiocyanate | 1.27 (0.79, 1.76) | <0.001 | 0.91 (0.85, 0.97) | 0.004 |
| **PNT-traditional†** |  |  |  |  |
| Perchlorate | 2.70 (2.10, 3.30) | <0.001 | 0.92 (0.83, 1.02) | 0.108 |
| Nitrate | 7.17 (6.17, 8.17) | <0.001 | 0.65 (0.58, 0.73) | <0.001 |
| Thiocyanate | 2.76 (2.29, 3.23) | <0.001 | 0.87 (0.82, 0.92) | <0.001 |

BMI: Body mass index; CIs: Confidence intervals; CKD: Chronic kidney disease; eGFR: Estimated glomerular filtration rate; HEI: Healthy eating index; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, and medicine use.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

‡OR and 95% CIs for CKD in logistic regressions.

**Supplementary Table 7: Associations between individual PNT and ACR in the first sensitivity analysis (*N* = 11,066).**

|  |  |  |
| --- | --- | --- |
| **Multivariable regression** | **Adjusted β (95% CI)** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |
| Perchlorate | −0.04 (−0.06, −0.01) | 0.002 |
| Nitrate | −0.06 (−0.09, −0.04) | <0.001 |
| Thiocyanate | −0.03 (−0.05, −0.01) | 0.001 |
| **PNT-new\*** |  |  |
| Perchlorate | −0.05 (−0.08, −0.02) | 0.004 |
| Nitrate | 1.96 (0.97, 2.95) | <0.001 |
| Thiocyanate | −0.1 (−0.14, −0.07) | <0.001 |
| **PNT-traditional†** |  |  |
| Perchlorate | −0.04 (−0.08, −0.01) | 0.012 |
| Nitrate | −0.09 (−0.13, −0.06) | <0.001 |
| Thiocyanate | −0.03 (−0.05, −0.01) | 0.007  |

ACR: Albumin-to-creatinine ratio; BMI: Body mass index; CI: Confidence interval; HEI: Healthy eating index; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, and medicine use.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

**Supplementary Table 8: Associations between individual PNT and eGFR, and risk of CKD in the second sensitivity analysis (*N* = 8938).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Multivariable regression** | **Adjusted β (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)‡** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |  |  |
| Perchlorate | −0.54 (−1.10, 0.02) | 0.062 | 1.01 (0.94, 1.09) | 0.721 |
| Nitrate | 0.59 (−0.12, 1.30) | 0.106 | 0.83 (0.75, 0.91) | <0.001 |
| Thiocyanate | 1.06 (0.60, 1.52) | <0.001 | 0.90 (0.84, 0.97) | 0.005 |
| **PNT-new\*** |  |  |  |  |
| Perchlorate | −0.31 (−1.05, 0.43) | 0.419 | 0.94 (0.84, 1.04) | 0.235 |
| Nitrate | 2.04 (0.93, 3.14) | 0.001 | 0.64 (0.57, 0.73) | <0.001 |
| Thiocyanate | 1.36 (0.81, 1.91) | <0.001 | 0.87 (0.81, 0.93) | <0.001 |
| **PNT-traditional†** |  |  |  |  |
| Perchlorate | 2.77 (2.11, 3.42) | <0.001 | 1.04 (0.93, 1.15) | 0.482 |
| Nitrate | 7.30 (6.14, 8.46) | <0.001 | 0.74 (0.65, 0.85) | <0.001 |
| Thiocyanate | 2.90 (2.36, 3.44) | <0.001 | 0.91 (0.85, 0.97) | 0.007 |

BMI: Body mass index; CIs: Confidence intervals; CKD: Chronic kidney disease; eGFR: Estimated glomerular filtration rate; HEI: Healthy eating index; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, medicine use, serum total cholesterol level, diabetes, hypertension, and cardiovascular disease.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

‡OR and 95% CIs for CKD in logistic regressions.

**Supplementary Table 9: Associations between individual PNT and ACR in the second sensitivity analysis (*N* = 8938).**

|  |  |  |
| --- | --- | --- |
| **Multivariable regression** | **Adjusted β (95% CI)** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |
| Perchlorate | −0.03 (−0.05, 0) | 0.025 |
| Nitrate | −0.06 (−0.09, −0.03) | <0.001 |
| Thiocyanate | −0.03 (−0.05, −0.01) | 0.010  |
| **PNT-new\*** |  |  |
| Perchlorate | −0.04 (−0.07, −0.01) | 0.025 |
| Nitrate | −0.11 (−0.15, −0.07) | <0.001 |
| Thiocyanate | −0.03 (−0.05, −0.01) | 0.01 |
| **PNT-traditional†** |  |  |
| Perchlorate | −0.03 (−0.06, 0) | 0.082 |
| Nitrate | −0.09 (−0.13, −0.05) | <0.001 |
| Thiocyanate | −0.02 (−0.05, 0) | 0.025  |

ACR: Albumin-to-creatinine ratio; BMI: Body mass index; CI: Confidence interval; HEI: Healthy eating index; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, medicine use, serum total cholesterol level, diabetes, hypertension, and cardiovascular disease.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

**Supplementary Table 10: Associations between individual PNT and eGFR, and ACR in the third sensitivity analysis (*N* = 6859).**

|  |  |  |
| --- | --- | --- |
| **Items** | **eGFR** | **ACR** |
| **Adjusted β (95% CI)** | ***P*-value** | **Adjusted β (95% CI)** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |  |  |
| Perchlorate | −0.04 (−0.46, 0.38) | 0.854 | −0.01 (−0.04, 0.01) | 0.360  |
| Nitrate | 0 (−0.53, 0.53) | 0.996 | −0.03 (−0.06, 0.01) | 0.116 |
| Thiocyanate | 0.63 (0.24, 1.02) | 0.002 | −0.02 (−0.05, 0.01) | 0.224 |
| **PNT-new\*** |  |  |  |  |
| Perchlorate | 0.31 (−0.29, 0.90) | 0.313 | −0.03 (−0.07, 0) | 0.077 |
| Nitrate | 0.67 (−0.06, 1.41) | 0.078 | −0.08 (−0.13, −0.04) | 0.001 |
| Thiocyanate | 0.85 (0.40, 1.29) | <0.001 | −0.03 (−0.05, 0) | 0.061 |
| **PNT-traditional†** |  |  |  |  |
| Perchlorate | 1.65 (1.09, 2.22) | <0.001 | −0.03 (−0.07, 0.01) | 0.139 |
| Nitrate | 3.12 (2.34, 3.89) | <0.001 | −0.07 (−0.12, −0.02) | 0.003 |
| Thiocyanate | 1.54 (1.10, 1.98) | <0.001 | −0.02 (−0.05, 0) | 0.094 |

ACR: Albumin-to-creatinine ratio; BMI: Body mass index; CI: Confidence interval; eGFR: Estimated glomerular filtration rate; HEI: Healthy eating index; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT and ACR were ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, medicine use, serum total cholesterol level, diabetes, hypertension, and cardiovascular disease.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

**Supplementary Table 11: Associations between individual PNT and eGFR, and risk of CKD in the fourth sensitivity analysis (*N* = 7046).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Multivariable regression** | **Adjusted β (95% CI)** | ***P*-value** | **Adjusted OR (95% CI)‡** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |  |  |
| Perchlorate | −0.35 (−0.96, 0.26) | 0.265 | 1.05 (0.97, 1.14) | 0.257 |
| Nitrate | 0.80 (−0.01, 1.61) | 0.053 | 0.85 (0.76, 0.95) | 0.004 |
| Thiocyanate | 0.95 (0.40, 1.50) | 0.001 | 0.92 (0.85, 1.00) | 0.058 |
| **PNT-new\*** |  |  |  |  |
| Perchlorate | −0.31 (−1.17, 0.54) | 0.473 | 1.08 (0.96, 1.21) | 0.195 |
| Nitrate | 1.89 (0.53, 3.25) | 0.009 | 0.77 (0.66, 0.9) | 0.002 |
| Thiocyanate | 1.11 (0.43, 1.79) | 0.002 | 0.93 (0.86, 1.00) | 0.064 |
| **PNT-traditional†** |  |  |  |  |
| Perchlorate | 2.85 (2.09, 3.60) | <0.001 | 0.98 (0.87, 1.10) | 0.684 |
| Nitrate | 7.37 (5.88, 8.86) | <0.001 | 0.67 (0.57, 0.78) | <0.001 |
| Thiocyanate | 2.79 (2.14, 3.45) | <0.001 | 0.88 (0.82, 0.95) | 0.003 |

BMI: Body mass index; CIs: Confidence intervals; CKD: Chronic kidney disease; eGFR: Estimated glomerular filtration rate; HEI: Healthy eating index; OR: Odds ratio; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, medicine use, serum total cholesterol level, diabetes, hypertension, and cardiovascular disease.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.

‡OR and 95% CIs for CKD in logistic regressions.

**Supplementary Table 12: Associations between individual PNT and ACR in the second sensitivity analysis (*N* = 7046).**

|  |  |  |
| --- | --- | --- |
| **Multivariable regression** | **Adjusted β (95% CI)** | ***P*-value** |
| **PNT non-CR-adjusted** |  |  |
| Perchlorate | −0.02 (−0.05, 0) | 0.089 |
| Nitrate | −0.06 (−0.09, −0.03) | 0.001 |
| Thiocyanate | −0.02 (−0.04, 0.01) | 0.161 |
| **PNT-new\*** |  |  |
| Perchlorate | −0.03 (−0.06, 0.01) | 0.114 |
| Nitrate | −0.11 (−0.15, −0.06) | <0.001 |
| Thiocyanate | −0.02 (−0.04, 0.01) | 0.200  |
| **PNT-traditional†** |  |  |
| Perchlorate | −0.02 (−0.06, 0.02) | 0.303 |
| Nitrate | −0.09 (−0.13, −0.04) | <0.001 |
| Thiocyanate | −0.01 (−0.04, 0.01) | 0.360  |

ACR: Albumin-to-creatinine ratio; BMI: Body mass index; CI: Confidence interval; HEI: Healthy eating index; PNT: Perchlorate, nitrate, and thiocyanate; CR, creatinine.

PNT was ln-transformed. Adjusted model was adjusted for: age, sex, race, family income-to-poverty ratio, education, BMI, HEI, alcohol consumption, physical activity, cigarettes per day, medicine use, serum total cholesterol level, diabetes, hypertension, and cardiovascular disease.

\*After covariate-adjusted creatinine standardization.

†After traditional creatinine adjustment.