*animal* journal

**Genetic (co)variances between milk mineral concentration and chemical composition in lactating Holstein-Friesian dairy cows**

G. Visentin, G. Niero, D. Berry, A. Costa,M. Cassandro, M. De Marchi and M. Penasa

**Supplementary Table S1.** Heritability (h2; standard error in parentheses) estimated using the random regression model for calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), and phosphorus (P) concentration, chemical composition, pH, and somatic cell score (SCS) of cow milk at 30 days-in-milk (DIM), 150 DIM, and 270 DIM.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 30 DIM |  | 150 DIM |  | 270 DIM |
| Trait | h2 (SE) |  | h2 (SE) |  | h2 (SE) |
| Ca (mg/kg) | 0.33 (0.04) |  | 0.66 (0.04) |  | 0.63 (0.04) |
| K (mg/kg) | 0.19 (0.03) |  | 0.21 (0.03) |  | 0.21 (0.03) |
| Mg (mg/kg) | 0.08 (0.02) |  | 0.29 (0.03) |  | 0.35 (0.04) |
| Na (mg/kg) | 0.16 (0.03) |  | 0.25 (0.04) |  | 0.34 (0.04) |
| P (mg/kg) | 0.21 (0.03) |  | 0.53 (0.04) |  | 0.54 (0.04) |
| Protein (%) | 0.07 (0.01) |  | 0.61 (0.05) |  | 0.67 (0.04) |
| Casein (%) | 0.07 (0.02) |  | 0.59 (0.05) |  | 0.66 (0.04) |
| Fat (%) | 0.09 (0.03) |  | 0.37 (0.04) |  | 0.49 (0.04) |
| Lactose (%) | 0.26 (0.04) |  | 0.43 (0.05) |  | 0.50 (0.04) |
| Urea (mg/dL) | 0.21 (0.04) |  | 0.32 (0.04) |  | 0.29 (0.04) |
| pH (units) | 0.33 (0.05) |  | 0.59 (0.05) |  | 0.61 (0.04) |
| SCS (units) | 0.05 (0.02) |  | 0.35 (0.04) |  | 0.19 (0.05) |

**Supplementary Table S2.** Genetic correlations (standard error in parentheses) estimated using the random regression model between calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), and phosphorus (P) concentration, and chemical composition, pH, and somatic cell score (SCS) of cow milk at 30 days-in-milk (DIM).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Ca | K | Mg | Na | P |
| K | 0.17 (0.10) |  |  |  |  |
| Mg | 0.64 (0.08) | 0.50 (0.12) |  |  |  |
| Na | -0.01 (0.11) | 0.43 (0.11) | 0.45 (0.14) |  |  |
| P | 0.28 (0.09) | 0.54 (0.08) | 0.56 (0.10) | 0.26 (0.12) |  |
| Protein | 0.29 (0.11) | -0.18 (0.13) | 0.50 (0.13) | -0.22 (0.15) | 0.37 (0.11) |
| Fat | 0.35 (0.12) | 0.03 (0.16) | 0.28 (0.19) | -0.23 (0.17) | -0.16 (0.14) |
| Lactose | 0.04 (0.10) | -0.59 (0.08) | -0.51 (0.11) | -0.26 (0.12) | -0.22 (0.11) |
| Urea | -0.28 (0.10) | -0.09 (0.12) | -0.57 (0.10) | -0.05 (0.13) | -0.25 (0.11) |
| pH | 0.55 (0.06) | -0.47 (0.08) | -0.42 (0.10) | -0.36 (0.09) | -0.19 (0.09) |
| SCS | -0.22 (0.17) | -0.19 (0.20) | 0.13 (0.26) | 0.44 (0.18) | -0.06 (0.19) |

**Supplementary Table S3.** Genetic correlations (standard error in parentheses) estimated using the random regression model between calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), and phosphorus (P) concentration, and chemical composition, pH, and somatic cell score (SCS) of cow milk at 150 days-in-milk (DIM).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Ca | K | Mg | Na | P |
| K | 0.26 (0.06) |  |  |  |  |
| Mg | 0.66 (0.03) | 0.68 (0.05) |  |  |  |
| Na | -0.01 (0.07) | 0.41 (0.09) | 0.14 (0.09) |  |  |
| P | 0.54 (0.03) | 0.77 (0.03) | 0.76 (0.03) | 0.15 (0.07) |  |
| Protein | 0.53 (0.03) | 0.23 (0.07) | 0.70 (0.03) | 0.13 (0.07) | 0.62 (0.03) |
| Fat | 0.55 (0.04) | 0.27 (0.08) | 0.71 (0.04) | -0.06 (0.09) | 0.51 (0.04) |
| Lactose | -0.09 (0.06) | -0.47 (0.07) | -0.39 (0.06) | -0.16 (0.09) | -0.21 (0.06) |
| Urea | -0.21 (0.06) | 0.01 (0.10) | -0.23 (0.08) | 0.00 (0.09) | -0.07 (0.07) |
| pH | 0.50 (0.04) | -0.39 (0.07) | -0.24 (0.06) | -0.39 (0.07) | -0.01 (0.06) |
| SCS | -0.03 (0.06) | -0.01 (0.09) | -0.04 (0.08) | 0.43 (0.07) | 0.01 (0.06) |

**Supplementary Table S4.** Genetic correlations (standard error in parentheses) estimated using the random regression model between calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), and phosphorus (P) concentration, and chemical composition, pH, and somatic cell score (SCS) of cow milk at 270 days-in-milk (DIM).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Ca | K | Mg | Na | P |
| K | 0.12 (0.07) |  |  |  |  |
| Mg | 0.65 (0.03) | 0.62 (0.06) |  |  |  |
| Na | -0.01 (0.06) | 0.54 (0.07) | 0.36 (0.07) |  |  |
| P | 0.53 (0.04) | 0.75 (0.04) | 0.72 (0.03) | 0.23 (0.07) |  |
| Protein | 0.45 (0.03) | 0.18 (0.07) | 0.68 (0.03) | 0.26 (0.05) | 0.63 (0.03) |
| Fat | 0.54 (0.04) | 0.20 (0.08) | 0.73 (0.03) | 0.03 (0.07) | 0.55 (0.04) |
| Lactose | -0.04 (0.05) | -0.51 (0.06) | -0.53 (0.05) | -0.13 (0.07) | -0.24 (0.06) |
| Urea | -0.28 (0.06) | 0.07 (0.10) | -0.30 (0.08) | -0.06 (0.09) | -0.09 (0.08) |
| pH | 0.53 (0.03) | -0.41 (0.06) | -0.29 (0.06) | -0.49 (0.05) | -0.02 (0.06) |
| SCS | -0.16 (0.09) | 0.11 (0.13) | 0.07 (0.11) | 0.57 (0.08) | 0.07 (0.10) |