## Supplementary Materials

**Table S1.** Descriptive statistics for milk production traits and individual fatty acids (n = 297).

| Traits [1] | Common Name | Mean | SD | P1 [2] | P99 [2] |
|---|---|---|---|---|---|
| Milk yield, kg | | 37.86 | 8.31 | 20.54 | 59.03 |
| Milk composition, kg | | | | | |
| Fat | | 3.55 | 0.71 | 1.78 | 5.36 |
| Protein | | 3.22 | 0.41 | 2.59 | 3.88 |
| Individual fatty acids, g/100 g of total | | | | | |
| SFA | | | | | |
| 4:0 | Butyric acid | 1.66 | 0.31 | 1.09 | 2.42 |
| 6:0 | Caproic acid | 1.66 | 0.28 | 1.03 | 2.47 |
| 8:0 | Caprylic acid | 1.25 | 0.20 | 0.74 | 1.75 |
| 10:0 | Capric acid | 2.97 | 0.57 | 1.45 | 4.06 |
| 11:0 | Undecanoic acid | 0.11 | 0.05 | 0.02 | 0.23 |
| 12:0 | Lauric acid | 3.55 | 0.72 | 1.66 | 4.93 |
| 13:0 iso | iso Tridecanoic acid | 0.03 | 0.01 | 0.01 | 0.05 |
| 13:0 | Tridecanoic acid | 0.24 | 0.08 | 0.08 | 0.42 |
| 14:0 iso | iso Tetradecanoic acid | 0.12 | 0.03 | 0.05 | 0.19 |
| 14:0 | Myristic acid | 11.02 | 1.37 | 7.47 | 13.66 |
| 15:0 iso | iso Pentadecanoic acid | 0.20 | 0.04 | 0.12 | 0.29 |
| 15:0 ante | ante Pentadecanoic acid | 0.41 | 0.06 | 0.24 | 0.54 |
| 15:0 | Pentadecanoic acid | 1.28 | 0.30 | 0.62 | 1.89 |
| 16:0 iso | iso Hesadecanoic acid | 0.25 | 0.06 | 0.16 | 0.43 |
| 16:0 | Palmitic acid | 30.62 | 2.73 | 25.66 | 38.03 |
| 17:0 iso | iso Heptadecanoic acid | 0.33 | 0.04 | 0.24 | 0.45 |
| 17:0 ante | ante Heptadecanoic acid | 0.43 | 0.08 | 0.30 | 0.63 |
| 17:0 | Margaric acid | 0.57 | 0.09 | 0.41 | 0.84 |
| 18:0 | Stearic acid | 10.93 | 2.18 | 6.71 | 16.81 |
| 20:0 | Arachidic acid | 0.18 | 0.04 | 0.10 | 0.29 |
| 22:0 | Behenic acid | 0.06 | 0.02 | 0.03 | 0.10 |
| 24:0 | Lignoceric acid | 0.04 | 0.01 | 0.02 | 0.08 |
| MUFA | | | | | |
| 10:1 (c9) | Caproleic acid | 0.28 | 0.07 | 0.07 | 0.42 |
| 14:1 (c9) | Myristoleic acid | 0.84 | 0.24 | 0.33 | 1.40 |
| 16:1 (t9) | Palmitelaidic acid | 0.20 | 0.04 | 0.13 | 0.29 |
| 16:1 (c9) | Palmitoleic acid | 1.44 | 0.36 | 0.72 | 2.51 |
| 18:1 (t6+t8) | Trans 6-8-Octadecenoic acid | 0.16 | 0.03 | 0.11 | 0.25 |
| 18:1 (t9) | Elaidic acid | 0.30 | 0.06 | 0.19 | 0.53 |
| 18:1 (t10) | Trans 10-Octadecenoic acid | 0.40 | 0.16 | 0.17 | 1.10 |
| 18:1 (t11) | Vaccenic acid | 0.61 | 0.15 | 0.38 | 1.10 |
| 18:1 (c9) | Oleic acid | 20.18 | 3.35 | 12.66 | 28.95 |
| 18:1 (c12) | Cis 12-Octadecenoic acid | 0.39 | 0.10 | 0.16 | 0.65 |
| 18:1 (t16+c14) | Trans 16 + cis14 Octadecenoic | 0.25 | 0.05 | 0.12 | 0.34 |
| 20:1 (c9) | Gadoleic acid | 0.11 | 0.02 | 0.06 | 0.16 |
| PUFA | | | | | |
| 18:2 (t9, t12) | Linoelaidic acid | 0.24 | 0.05 | 0.14 | 0.37 |
| 18:2 (c9, c12) | Linoleic acid | 2.61 | 0.76 | 0.16 | 3.95 |

| | | | | | |
|---|---|---|---|---|---|
| 18:3 (c9, c12, c15) | α-Linolenic acid | 0.44 | 0.09 | 0.10 | 0.61 |
| 18:2 (c9, t11) | Rumenic acid | 0.30 | 0.08 | 0.06 | 0.47 |
| 20:3 (c8, c11, c14) | Eicosatrienoic acid | 0.14 | 0.04 | 0.02 | 0.23 |
| 20:4 (c5, c8, c11, c14) | Arachidonic acid | 0.17 | 0.04 | 0.07 | 0.27 |
| 20:5 (c5, c8, c11, c14, c17) | Eicosapentaenoic acid | 0.05 | 0.01 | 0.02 | 0.09 |
| 22:4 (c7, c10, c13, c16) | Docosatetraenoic acid | 0.05 | 0.02 | 0.02 | 0.12 |
| 22:5 (c7, c10, c13, c16, c19) | Docopentaenoic acid | 0.09 | 0.02 | 0.04 | 0.13 |

[1] c = cis; t = trans; SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids. [2] P1 = 1st percentile; P99 = 99th percentile.

**Table S2.** Descriptive statistics for all indicators of metabolic stress (n = 297).

| **Traits** [1] | **Mean** | **SD** | **P1** [2] | **P99** [2] |
|---|---|---|---|---|
| Body measure | | | | |
| BCS, score | 3.10 | 0.24 | 2.50 | 3.50 |
| Ultrasound measurements | | | | |
| pTAG, mg/g | 69.76 | 10.20 | 50.75 | 94.67 |
| PVA, $mm^2$ | 1110.03 | 287.66 | 567.88 | 1886.19 |
| PVD, mm | 129.71 | 12.98 | 95.87 | 161.26 |
| LD, mm | 148.75 | 13.02 | 117.36 | 178.84 |
| Hematochemical parameters | | | | |
| Hematocrit, l/l | 0.31 | 0.03 | 0.24 | 0.36 |
| Energy-related metabolites | | | | |
| Glucose, mmol/L | 4.35 | 0.39 | 3.29 | 5.22 |
| Cholesterol, mmol/L | 4.63 | 1.23 | 1.90 | 7.88 |
| NEFA, mmol/L | 0.18 | 0.22 | 0.04 | 1.05 |
| BHB, mmol/L | 0.56 | 0.26 | 0.27 | 1.30 |
| Urea, mmol/L | 6.30 | 1.07 | 4.10 | 8.77 |
| Creatinine, μmol/L | 81.82 | 6.37 | 71.74 | 99.47 |
| Liver function/hepatic damage | | | | |
| AST, U/L | 96.06 | 24.18 | 68.25 | 166.05 |
| GGT, U/L | 25.65 | 10.36 | 13.32 | 75.39 |
| BILt, μmol/L | 2.65 | 1.80 | 0.68 | 11.05 |
| Albumin, g/L | 37.01 | 2.30 | 30.60 | 42.04 |
| ALP, U/L | 63.55 | 23.64 | 22.70 | 134.21 |
| PON, U/mL | 105.87 | 20.64 | 53.87 | 158.27 |
| Oxidative stress metabolites | | | | |
| ROMt, mgH2O2/100mL | 12.44 | 3.26 | 5.00 | 20.24 |
| AOPP, μmol/L | 45.82 | 9.54 | 25.50 | 70.63 |
| FRAP, μmol/L | 198.42 | 72.83 | 125.28 | 331.55 |
| SHp, μmol/l | 376.92 | 48.64 | 266.67 | 510.25 |
| Inflammation/innate immunity | | | | |
| Ceruloplasmin, μmol/L | 1.80 | 0.61 | 0.79 | 3.73 |
| PROTt, g/L | 80.71 | 4.93 | 69.06 | 95.07 |
| Globulins, g/L | 43.69 | 5.32 | 34.28 | 59.17 |
| Haptoglobin, g/L | 0.39 | 0.34 | 0.10 | 1.50 |
| MPO, U/L | 453.97 | 68.07 | 286.10 | 663.21 |
| Minerals | | | | |
| Ca, mmol/L | 2.52 | 0.12 | 2.19 | 2.78 |
| P, mmol/L | 1.95 | 0.36 | 1.07 | 2.82 |

| | | | | |
|---|---|---|---|---|
| Mg, mmol/L | 1.00 | 0.10 | 0.72 | 1.22 |
| Na, mmol/L | 142.21 | 3.04 | 135.26 | 148.12 |
| K, mmol/L | 4.10 | 0.42 | 3.07 | 5.06 |
| Cl, mmol/L | 101.48 | 3.22 | 92.95 | 109.15 |
| Zn, μmol/L | 11.29 | 2.79 | 6.37 | 20.96 |

[1] BCS = body condition score; pTAG = predicted liver triacylglycerol; PVA = portal vein area; PVD = portal vein depth; LD = liver depth; NEFA = non-esterified fatty acids; BHB = β-Hydroxybutyrate; AST = aspartate aminotransferase; GGT = γ-glutamyl transferase; BILt = total bilirubin; ALP = alkaline phosphatase; PON = paraoxonase; ROMt =total reactive oxygen metabolites; AOPP = advanced oxidation protein products; FRAP = ferric reducing antioxidant power; SHp = total thiol groups; PROTt = total proteins; MPO = myeloperoxidase. [2] P1 = 1st percentile; P99 = 99th percentile.