**Supplementary File 1a**.Maximal activities (µmol/g tissue/min), body mass (g) and myoglobin (Mb; mg/g tissue) concentration in pectoralis muscle.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cinnamon teal** | | | **Yellow-billed**  **pintail** | | | **Ruddy duck** | | | **Crested duck** | | | | | **Puna teal (H)**  **Silver teal (L)** | | | | | **Speckled teal** | | | | **Andean goose (H)**  **Magellan goose (L)** | | | | | |
|  | **LA** | **HA** | **LA** | | **HA** | **LA** | | **HA** | **LA** | | | **HA** | | **LA** | | | **HA** | | **LA** | | | **HA** | | | **LA** | | **HA** | |
| Mass | 515.5  ± 24.5 | 510.83  ± 9.57 | 793.0  ± 18.46 | | 685.83  ± 15.1 | 631.5  ± 18.32 | | 824.17  ± 38.91 | 954.5  ± 29.8 | | | 1038.63  ± 39.35 | | 435.0  ± 9.43 | | | 468.57  ± 9.31 | | 435.5  ± 12.17 | | | 413.75  ± 12.23 | | | 2701.7  ± 221.36 | | 2503.85  ± 150.28 | |
| Mb | 4.80  ± 0.45 | 5.40  ± 0.36 | 9.96  ± 0.23 | | 9.41  ± 0.45 | 7.24  ± 0.35 | | 6.88  ± 0.44 | 7.37  ± 0.46 | | | ***\*9.70***  ***± 0.67*** | | 6.01  ± 0.24 | | | 7.29  ± 0.49 | | 6.58  ± 0.55 | | | 7.99  ± 0.47 | | | 8.77  ± 0.80 | | 9.66  ± 0.82 | |
| ***Carbohydrate metabolism*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HK | 0.399  ± 0.050 | ***\*0.881***  ***± 0.038*** | 0.398  ± 0.068 | | ***\*0.897***  ***± 0.093*** | 1.281  ± 0.156 | | 1.184  ± 0.114 | 0.474  ± 0.078 | | | ***\*1.686***  ***± 0.148*** | | 0.410  ± 0.046 | | | 0.565  ± 0.110 | | 0.359  ± 0.057 | | | 0.439  ± 0.057 | | | 0.264  ± 0.089 | | 0.512  ± 0.063 | |
| PK | 515.69  ± 43.09 | 464.12  ± 32.28 | 566.23  ± 42.57 | | 504.04  ± 22.48 | 327.60  ± 13.43 | | 398.60  ± 26.40 | 581.74  ± 55.29 | | | 449.22  ± 39.51 | | 574.09  ± 36.16 | | | 502.06  ± 23.70 | | 546.62 ± 46.95 | | | ***\*280.51***  ***± 28.31*** | | | 372.27  ± 32.40 | | 393.56  ± 20.52 | |
| LDH | 348.51  ± 17.22 | 307.71  ± 12.20 | 359.57  ± 16.94 | | 317.58  ± 14.28 | 407.24  ± 34.14 | | ***\*227.49***  ***± 12.44*** | 363.77  ± 25.26 | | | ***\*249.27***  ***± 11.12*** | | 425.06  ± 23.63 | | | ***\*332.94***  ***± 13.56*** | | 392.79 ± 28.31 | | | ***\*290.54***  ***± 11.56*** | | | 379.27  ± 19.91 | | ***\*279.66***  ***± 7.98*** | |
| ***Citric acid cycle*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| CS | 76.23  ± 7.42 | 94.91  ± 6.87 | 76.01  ± 7.04 | | 83.17  ± 5.41 | 115.40  ± 7.82 | | 102.97  ± 7.95 | 83.79  ± 6.70 | | | 95.80  ± 5.50 | | 81.58  ± 10.88 | | | 65.09  ± 5.24 | | 87.02  ± 10.88 | | | 95.82  ± 6.84 | | | 76.87  ± 4.87 | | 74.33  ± 5.29 | |
| IDH | 19.52  ± 1.50 | 23.06  ± 1.17 | 22.81  ± 0.53 | | 21.56  ± 1.30 | 22.65  ± 2.22 | | 19.53  ± 1.37 | 15.67  ± 1.53 | | | 19.07  ± 2.14 | | 20.45  ± 1.18 | | | 17.12  ± 1.38 | | 23.81  ± 0.88 | | | 20.75  ± 1.42 | | | 26.41  ± 3.30 | | 24.10  ± 1.70 | |
| MDH | 749.35  ± 42.13 | 873.41  ± 53.07 | 804.34  ± 84.57 | | 696.72  ± 84.34 | 665.72  ± 37.88 | | 699.00  ± 51.59 | 809.19  ± 66.10 | | | 801.91  ± 46.46 | | 819.14  ± 62.41 | | | 634.06  ± 90.62 | | 897.16  ± 81.00 | | | 699.31  ± 68.05 | | | 957.75  ± 84.89 | | 782.28  ± 50.54 | |
| ***Electron transport chain*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| CI | 5.77  ± 0.87 | 5.66  ± 1.14 | 1.74  ± 0.40 | | 1.26  ± 0.22 | 1.30  ± 0.19 | | 2.21  ± 0.43 | 1.86  ± 0.41 | | | 3.48  ± 0.56 | | 3.71  ± 0.66 | | | 5.25  ± 0.82 | | 1.56  ± 0.39 | | | 2.02  ± 0.27 | | | 2.67  ± 0.85 | | 2.63  ± 0.29 | |
| CII | 3.41  ± 0.27 | 4.5  ± 0.28 | 4.85  ± 0.39 | | 4.78  ± 0.19 | 5.34  ± 0.18 | | 4.23  ± 0.18 | 4.40  ± 0.27 | | | 5.10  ± 0.28 | | 3.66  ± 0.29 | | | 3.84  ± 0.27 | | 3.38  ± 0.29 | | | ***\*5.08***  ***± 0.29*** | | | 3.61  ± 0.19 | | 4.00  ± 0.23 | |
| CIV | 39.88  ± 6.67 | ***\*25.69***  ***± 2.44*** | 61.36  ± 3.61 | | ***\*24.42***  ***± 3.12*** | 10.77  ± 1.31 | | ***\*26.75***  ***± 4.04*** | 58.41  ± 2.14 | | | ***\*26.64***  ***± 2.92*** | | 55.92  ± 2.72 | | | ***\*24.79***  ***± 3.66*** | | 56.86  ± 1.97 | | | ***\*25.99***  ***± 3.36*** | | | 72.63  ± 5.64 | | ***\*21.62***  ***± 2.86*** | |
| ATPsyn | 7.74  ± 1.65 | 9.59  ± 2.36 | 7.63  ± 2.31 | | 11.09  ± 3.37 | 10.03  ± 2.06 | | 7.20  ± 1.78 | 6.93  ± 1.34 | | | 14.01  ± 4.55 | | 7.86  ± 1.33 | | | ***\*15.73***  ***± 1.90*** | | 6.66  ± 1.49 | | | ***\*18.58***  ***± 3.08*** | | | 6.10  ± 2.50 | | ***\*18.84***  ***± 2.54*** | |
| ***Fatty acid metabolism*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| HOAD | 15.23  ± 1.03 | ***\*22.74***  ***± 1.11*** | 11.53  ± 0.73 | | ***\*25.37***  ***± 1.11*** | 52.87  ± 0.94 | | ***\*29.39***  ***± 1.48*** | 8.50  ± 0.44 | | | ***\*16.31***  ***± 1.15*** | | 11.74  ± 0.52 | | | ***\*19.21***  ***± 0.81*** | | 11.74  ± 0.74 | | | ***\*16.46***  ***± 1.17*** | | | 11.29  ± 0.53 | | ***\*13.73***  ***± 0.49*** | |
| ***Adenylate metabolism*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| AK | 220.53  ± 8.10 | 183.06  ± 7.52 | 245.65  ± 17.16 | | 268.57  ± 9.68 | 180.53  ± 11.90 | | 175.45  ± 9.49 | 267.72  ± 11.58 | | | 241.08  ± 7.62 | | 269.10  ± 12.70 | | | 265.93  ± 17.09 | | 251.08  ± 21.29 | | | 234.40  ± 6.29 | | | 296.86  ± 47.21 | | 231.79  ± 7.34 | |
| CK | 65.68  ± 4.49 | ***\*36.05***  ***± 2.17*** | 71.42  ± 5.78 | | ***\*42.74***  ***± 5.12*** | 52.38  ± 6.37 | | ***\*31.32***  ***± 5.48*** | 67.01  ± 4.13 | | | ***\*27.81***  ***± 5.39*** | | 63.86  ± 7.95 | | | ***\*32.45***  ***± 4.87*** | | 78.08  ± 7.50 | | | ***\*41.90***  ***± 6.23*** | | | 26.79  ± 1.17 | | ***\*13.84***  ***± 2.16*** | |

Values are given in as the mean ± SEM (*n* = 8-12). \* - Significant pairwise differences between the high-altitude and low-altitude populations within a high-low pair in Bonferroni post-tests (P < 0.05). List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1b**.Two-factor ANOVA results of maximal activities (µmol/g tissue/min), mass (g) and myoglobin (Mb; mg/g tissue) concentration in pectoralis muscle.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Altitude** | **Species** | **Interaction** |
| Mass | F1,120 = 0.00135, P = 0.9707 | F6,120 = 50.35, **P < 0.0001** | F6,120 = 0.3430, P = 0.9127 |
| Mb | F1,120 = 7.358, **P = 0.0077** | F6,120 = 16.82, **P < 0.0001** | F6,120 = 1.686, P = 0.1301 |
| ***Carbohydrate metabolism*** | | | |
| HK | F1,120 = 49.80, **P < 0.0001** | F6,120 = 23.31, **P < 0.0001** | F6,120 = 9.633, **P < 0.0001** |
| PK | F1,120 = 13.57, **P = 0.0003** | F6,120 = 8.669, **P < 0.0001** | F6,120 = 4.641, **P = 0.0003** |
| LDH | F1,120 = 82.29, **P < 0.0001** | F6,120 = 2.721, **P = 0.0163** | F6,120 = 2.854, **P = 0.0124** |
| ***Citric acid cycle*** | | | |
| CS | F1,120 = 0.310, P = 0.5787 | F6,120 = 5.583, **P < 0.0001** | F6,120 = 1.602, P = 0.1525 |
| IDH | F1,120 = 0.916, P = 0.3406 | F6,120 = 4.436, **P = 0.0004** | F6,120 = 1.583, P = 0.1577 |
| MDH | F1,120 = 3.993, **P = 0.0480** | F6,120 = 1.630, P = 0.1445 | F6,120 = 1.650, P = 0.1393 |
| ***Electron transport chain*** | | | |
| CI | F1,120 = 3.137, P = 0.0791 | F6,120 = 14.46, **P < 0.0001** | F6,120 = 0.9882, P = 0.4365 |
| CII | F1,120 = 7.836, **P = 0.0060** | F6,120 = 5.808, **P < 0.0001** | F6,120 = 5.190, **P < 0.0001** |
| CIV | F1,120 = 192.6, **P < 0.0001** | F6,120 = 15.06, **P < 0.0001** | F6,120 = 18.95, **P < 0.0001** |
| ATPsyn | F1,120 = 19.45, **P < 0.0001** | F6,120 = 0.780, P = 0.5874 | F6,120 = 2.362, **P = 0.0342** |
| ***Fatty acid metabolism*** | | | |
| HOAD | F1,120 = 31.93, **P < 0.0001** | F6,120 = 221.1, **P < 0.0001** | F6,120 = 79.95, **P < 0.0001** |
| ***Adenylate metabolism*** | | | |
| AK | F1,120 = 3.910, P = 0.0503 | F6,120 = 9.216, **P < 0.0001** | F6,120 = 1.207, P = 0.3072 |
| CK | F1,120 = 91.95, **P < 0.0001** | F6,120 = 11.08, **P < 0.0001** | F6,120 = 1.301, P = 0.2620 |

Two‐factor ANOVA was used to evaluate the main effects and interactions of altitude on enzyme activity (high- vs. low-altitude populations across all species) and species on enzyme activity (species-specific differences across all altitudes). List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1c**.Two-factor ANOVA results of maximal activities (µmol/g tissue/min), mass (g) and myoglobin (Mb; mg/g tissue) concentration in pectoralis muscle excluding data for ruddy ducks from the subfamily *Oxyurinae*.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Altitude** | **Species** | **Interaction** |
| Mass | F1,106 = 0.1498, P = 0.6995 | F5,106 = 54.98, **P < 0.0001** | F5,106 = 0.2035, P = 0.9604 |
| Mb | F1,106 = 9.404, **P = 0.0027** | F5,106 = 19.00, **P < 0.0001** | F5,106 = 1.458, P = 0.2098 |
| ***Carbohydrate metabolism*** | | | |
| HK | F1,106 = 76.19, **P < 0.0001** | F5,106 = 16.92, **P < 0.0001** | F5,106 = 10.84, **P < 0.0001** |
| PK | F1,106 = 19.56, **P < 0.0001** | F5,106 = 6.397, **P < 0.0001** | F5,106 = 3.531, **P = 0.0054** |
| LDH | F1,106 = 63.27, **P < 0.0001** | F5,106 = 3.590, **P = 0.0049** | F5,106 = 1.629, P = 0.1587 |
| ***Citric acid cycle*** | | | |
| CS | F1,106 = 1.256, P = 0.2649 | F5,106 = 2.232, P = 0.0564 | F5,106 = 1.528, P = 0.1872 |
| IDH | F1,106 = 0.2803, P = 0.5976 | F5,106 = 5.779, **P < 0.0001** | F5,106 = 1.847, P = 0.1100 |
| MDH | F1,106 = 5.050, **P = 0.0267** | F5,106 = 1.018, P = 0.4111 | F5,106 = 1.626, P = 0.1594 |
| ***Electron transport chain*** | | | |
| CI | F1,106 = 2.023, P = 0.1579 | F5,106 = 14.55, **P < 0.0001** | F5,106 = 1.076, P = 0.3781 |
| CII | F1,106 = 16.72, **P = 0.0002** | F5,106 = 5.355, **P < 0.0001** | F5,106 = 2.640, **P = 0.0273** |
| CIV | F1,106 = 257.2, **P < 0.0001** | F5,106 = 3.583, **P = 0.0049** | F5,106 = 5.649, **P = 0.0001** |
| ATPsyn | F1,106 = 25.13, **P < 0.0001** | F5,106 = 0.6869, P = 0.6344 | F5,106 = 1.439, P = 0.2164 |
| ***Fatty acid metabolism*** | | | |
| HOAD | F1,106 = 185.6, **P < 0.0001** | F5,106 = 19.11, **P < 0.0001** | F5,106 = 8.531, **P < 0.0001** |
| ***Adenylate metabolism*** | | | |
| AK | F1,106 = 4.058, **P = 0.0465** | F5,106 = 4.506, **P = 0.0009** | F5,106 = 1.341, P = 0.2527 |
| CK | F1,106 = 90.95, **P < 0.0001** | F5,106 = 13.75, **P < 0.0001** | F5,106 = 1.436, P = 0.2174 |

Two‐factor ANOVA was used to evaluate the main effects and interactions of altitude on enzyme activity (high- vs. low-altitude populations across all species) and species on enzyme activity (species-specific differences across all altitudes). List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1d**.Test of covariance for enzyme activity (µmol/g tissue/min) or myoglobin content (Mb; mg/g tissue) and body mass (g).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Statistical results** | **Regression analysis** |  | |
| Mb | F1,12 = 4.371, P = 0.0585 | r2 = 0.2670 |  | |
| ***Carbohydrate metabolism*** | | | | |
| HK | F1,12 = 0.2995, P = 0.5943 | r2 = 0.02435 |  | |
| PK | F1,12 = 1.301, P = 0.2762 | r2 = 0.09784 |  | |
| LDH | F1,12 = 0.1856, P = 0.6742 | r2 = 0.01523 |  | |
| ***Citric acid cycle*** | | | |
| CS | F1,12 = 0.9914, P = 0.3391 | r2 = 0.07631 |  | |
| IDH | F1,12 = 4.045, P = 0.0673 | r2 = 0.2521 |  | |
| MDH | F1,12 = 2.739, P = 0.1858 | r2 = 0.1858 |  | |
| ***Electron transport chain*** | | | | |
| CI | F1,12 = 0.2976, P = 0.5954 | r2 = 0.02420 |  | |
| CII | F1,12 = 0.4830, P = 0.5003 | r2 = 0.03870 |  | |
| CIV | F1,12 = 0.6840, P = 0.4244 | r2 = 0.05393 |  | |
| ATPsyn | F1,12 = 0.1366, P = 0.7181 | r2 = 0.01126 |  | |
| ***Fatty acid metabolism*** | | | | |
| HOAD | F1,12 = 0.7024, P = 0.4184 | r2 = 0.05529 |  | |
| ***Adenylate metabolism*** | | | | |
| AK | F1,12 = 1.217, P = 0.2916 | r2 = 0.09207 |  | |
| CK | F1,12 = 4.131, P = 0.0649 | r2 = 0.2561 |  | |

List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1e**. Test of covariance for enzyme activity (µmol/g tissue/min) or myoglobin content (Mb; mg/g tissue) and body mass (g) excluding data for ruddy ducks from the subfamily *Oxyurinae*.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Statistical Results** | **Regression Analysis** |  | |
| Mb | F1,10 = 3.558, P = 0.0886 | r2 = 0.2624 |  | |
| ***Carbohydrate metabolism*** | | | | |
| HK | F1,10 = 0.1284, P = 0.7275 | r2 = 0.01268 |  | |
| PK | F1,10 = 2.141, P = 0.1741 | r2 = 0.1763 |  | |
| LDH | F1,10 = 0.1868, P = 0.6742 | r2 = 0.01834 |  | |
| ***Citric acid cycle*** | | | |
| CS | F1,10 = 3.851, P = 0.3730 | r2 = 0.08000 |  | |
| IDH | F1,10 = 4.045, P = 0.0781 | r2 = 0.2780 |  | |
| MDH | F1,10 = 2.210, P = 0.1680 | r2 = 0.1810 |  | |
| ***Electron transport chain*** | | | | |
| CI | F1,10 = 0.4597, P = 0.5132 | r2 = 0.04395 |  | |
| CII | F1,10 = 0.2776, P = 0.6098 | r2 = 0.02701 |  | |
| CIV | F1,10 = 0.4159, P = 0.5335 | r2 = 0.03993 |  | |
| ATPsyn | F1,10 = 0.09083, P = 0.7693 | r2 = 0.009002 |  | |
| ***Fatty acid metabolism*** | | | | |
| HOAD | F1,10 = 1.036, P = 0.3327 | r2 = 0.09388 |  | |
| ***Adenylate metabolism*** | | | | |
| AK | F1,10 = 1.113, P = 0.3162 | r2 = 0.1002 |  | |
| CK | F1,10 = 3.851, P = 0.0781 | r2 = 0.2780 |  | |

List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1f**. Correlation analyses of phylogenetic independent contrasts of bird mass (g), myoglobin (Mb) content (mg/g tissue), or enzyme activity (µmol/g tissue/min) *versus* altitude (m).

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pearson product-moment correlation coefficient** | **F2,10, P** | **R2** |
| Mass | -0.0683 | F2,12 = 0.0562, P = 0.8166 | r2 = 0. 0047 |
| Mb | 0.4943 | F2,12 = 3.8803, P = 0.0724 | r2 = 0.2443 |
| ***Carbohydrate metabolism*** | | | |
| HK | 0. 7160 | F2,12 = 12.6211, **P = 0.0040** | r2 = 0. 5126 |
| PK | -0.7455 | F2,12 = 15.0169, **P = 0.0021** | r2 = 0. 5558 |
| LDH | -0.8655 | F2,12 = 35.8287, **P < 0.0001** | r2 = 0.7491 |
| ***Citric acid cycle*** | | | |
| CS | 0.6128 | F2,12 = 7.2177, **P = 0.0198** | r2 = 0.3756 |
| IDH | -0.2884 | F2,12 = 1. 0886, P = 0.3173 | r2 = 0.0832 |
| MDH | -0.5350 | F2,12 = 4.8124, **P = 0.0487** | r2 = 0.2862 |
| ***Electron transport chain*** | | | |
| CI | 0.3024 | F2,12 = 1.2082, P = 0.2933 | r2 = 0.0915 |
| CII | 0.6070 | F2,12 = 7.0016, **P = 0.0213** | r2 = 0.3685 |
| CIV | -0.8502 | F2,12 = 31.2905, **P = 0.0001** | r2 = 0.7228 |
| ATPsyn | 0.7842 | F2,12 = 19.1688, **P = 0.0009** | r2 = 0.6150 |
| ***Fatty acid metabolism*** | | | |
| HOAD | 0.4356 | F2,12 = 2.8100, P = 0.1195 | r2 = 0.1897 |
| ***Adenylate metabolism*** | | | |
| AK | -0.3552 | F2,12 = 1.7324, P =0.2127 | r2 = 0.1262 |
| CK | -0.9777 | F2,12 = 259.6513, **P < 0.0001** | r2 = 0.9558 |

List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1g**. Correlation analyses of phylogenetic independent contrasts of bird mass (g), myoglobin (Mb) content (mg/g tissue), or enzyme activity (µmol/g tissue/min) *versus* altitude (m) excluding data for ruddy ducks from the subfamily *Oxyurinae*.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pearson product-moment correlation coefficient** | **F2,10, P** | **R2** |
| Mass | -0.1735 | F2,12 = 0.3103, P = 0.5898 | r2 = 0.0301 |
| Mb | 0.5527 | F2,12 = 4.3990, P = 0.0624 | r2 = 0.3055 |
| ***Carbohydrate metabolism*** | | | |
| HK | 0.7735 | F2,12 = 14.90, **P = 0.0032** | r2 = 0.5983 |
| PK | -0.8340 | F2,12 = 22.83904, **P = 0.0007** | r2 = 0.6955 |
| LDH | -0.9345 | F2,12 = 68.9180, **P < 0.0001** | r2 = 0.8733 |
| ***Citric acid cycle*** | | | |
| CS | 0.4035 | F2,12 = 3.2194, P = 0.0916 | r2 = 0.1615 |
| IDH | -0.2070 | F2,12 = 0.4476, P = 0.5186 | r2 = 0.0428 |
| MDH | -0.5855 | F2,12 = 5.2158, **P = 0.0455** | r2 = 0.3428 |
| ***Electron transport chain*** | | | |
| CI | 0.2198 | F2,12 = 0.5076, P = 0.4925 | r2 = 0.0483 |
| CII | 0.7767 | F2,12 = 15.2029, **P = 0.0030** | r2 = 0.6032 |
| CIV | -0.9595 | F2,12 = 116.0305, **P < 0.0001** | r2 = 0.9207 |
| ATPsyn | 0.8653 | F2,12 = 29.8020, **P = 0.0003** | r2 = 0.7488 |
| ***Fatty acid metabolism*** | | | |
| HOAD | 0.8837 | F2,12 = 35.6387, **P = 0.0001** | r2 = 0.7809 |
| ***Adenylate metabolism*** | | | |
| AK | -0.3606 | F2,12 = 1.4946, P =0.2495 | r2 = 0.1300 |
| CK | -0.9770 | F2,12 = 210.1855, **P < 0.0001** | r2 = 0.9546 |

List of abbreviations: HA = high altitude; LA = low altitude; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.

**Supplementary File 1h.** Assay conditions for enzymatic measurements.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **λ (nm)** | **ε (mmol-1 cm-1)** | | **pH** | **Substrates** | **Other reagents** | **Specific inhibitor** | | **Coupling enzymes** |
| ***Carbohydrate metabolism*** | | |  | | |  | |
| **HK** | 340 | 6.22 | | 7.2 | **\*Glucose (10 mM)**  Mg·ATP (3 mM)  MgCl2 (10 mM)  NADP+ (1.5 mM) | --- | --- | | 1 U G6PDH |
| **PK** | 340 | 6.22 | | 7.2 | **\*PEP (10 mM)**  Mg·ADP (2.5 mM) | --- | --- | | 1 U LDH |
| **LDH** | 340 | 6.22 | | 7.2 | **\*Pyruvate (5 mM)**  NADH (0.15 mM) | --- | --- | | --- |
| ***Citric acid cycle*** | | |  | | |  | |
| **CS** | 412 | 14.15 | | 8.0 | **\*Oxaloacetate (0.5 mM)**  Acetyl CoA (0.15 mM)  DTNB (0.15 mM) | --- | --- | | --- |
| **IDH** | 340 | 6.22 | | 8.0 | **\*Isocitrate (5 mM)**  NADP+ (1.5 mM) | --- | --- | | --- |
| **MDH** | 340 | 6.22 | | 8.0 | **\*Oxaloacetate (0.5 mM)**  NADP+ (1.5 mM) | --- | --- | | --- |
| ***Electron transport chain*** | | |  | | |  | |
| **CI** | 340 | 6.22 | | 7.5 | CoQ10 (0.06 mM)  NADH (0.15 mM) | BSA (3mg ml-1)  KCN (0.3 mM) | **\*Rotenone (0.02 mM)** | | --- |
| **CII** | 600 | 21.9 | | 7.5 | **\*Succinate (20 mM)**  DCPIP (XX mM)  DUB (XX mM) | KCN (0.3 mM) | --- | | --- |
| **CIV** | 550 | 28.5 | | 7.0 | **†CytcH2 (2 mM)** | --- | --- | | --- |
| **ATPsyn** | 340 | 6.22 | | 7.5 | Mg·ADP (2.5 mM)  MgCl2 (10 mM)  PEP (10 mM)  Glucose (10 mM)  NADP+ (1.5 mM) | --- | **\*Oligomycin (0.01 mM)** | | 1 U HK  1 U G6PDH |
| ***Fatty acid metabolism*** | | |  | | |  | |
| **HOAD** | 340 | 6.22 | | 7.2 | **\*Acetoacetyl CoA (0.15 mM)**  NADH (0.15 mM) | --- | --- | | --- |
| ***Adenylate metabolism*** | | |  | | |  | |
| **AK** | 340 | 6.22 | | 7.2 | **\*Mg·ADP (2.5 mM)**  MgCl2 (10 mM)  PEP (10 mM)  Glucose (10 mM)  NADP+ (1.5 mM) | --- | --- | | 1 U HK  1 U G6PDH |
| **CK** | 340 | 6.22 | | 7.2 | **\*Creatine (15 mM)**  Mg·ATP (6 mM)  MgCl2 (10 mM)  PEP (15 mM)  NADH (0.3 mM) | --- | --- | | 2 U PK  2 U LDH |

\* - Substrate omitted in measurement of background activity. † - Substrate auto-oxidation measured as background activity. List of abbreviations: Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; CK = creatine kinase; G6PDH = glucose-6-phosphate dehydrogenase; ATP = adenosine triphosphate; ADP = adenosine diphosphate; NADP = nicotinamide adenine dinucleotide phosphate; NADH = reduced nicotinamide adenine dinucleotide; CoA = coenzyme A; DTNB = Ellman's reagent (syn. 5,5'-dithiobis-2-nitrobenzoic acid); CoQ10 = ubiquinone; BSA = bovine serum albumin; DCPIP = 2,6-dichlorophenolindophenol; DUB = decylubiquinone (syn. 2,3-dimethoxy-5-methyl-6-decyl-1,4-benzoquinone); CytcH2 = reduced cytochrome c; and PEP = phosphoenolpyruvate

**Supplementary File 1i**. List of GenBank gene accession numbers for mtDNA control region used in the construction of the phylogenetic tree.

|  |  |
| --- | --- |
| **Species** | **Accession Numbers** |
|  |  |
| Yellow-billed Pintail | FJ618397-FJ618512 |
| Cinnamon Teal | JF914653-JF914754 |
| Ruddy Duck | AY747742-AY747751; AY747756-AY747778; AM084943-AM084997; JX910949-JX910971 |
| Crested Duck | HM063481-HM063503; JN833791-JN833847 |
| Puna Teal/Silver Teal | MN734269-MN734345 |
| Speckled Teal | JN223305-JN22337; MG520106-MG520175 |
| Andean Goose/Magellan Goose | KC109071-KC109080 |
|  |  |

**Supplementary File 1j**. Maximal activities (µmol/g tissue/min) in pectoralis muscle from surface, intermediate and deep tissue sampling locations.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cinnamon teal** | | | **Yellow-billed**  **pintail** | | | **Ruddy duck** | | | **Crested duck** | | | | | **Puna teal (H)**  **Silver teal (L)** | | | | | **Speckled teal** | | | | **Andean goose (H)**  **Magellan goose (L)** | | | | | |
|  | **LA** | **HA** | **LA** | | **HA** | **LA** | | **HA** | **LA** | | | **HA** | | **LA** | | | **HA** | | **LA** | | | **HA** | | | **LA** | | **HA** | |
| ***Carbohydrate metabolism*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HK  (S) | 0.318  ± 0.045 | 0.901  ± 0.073 | 0.421  ± 0.074 | | 1.169  ± 0.057 | 1.661  ± 0.047 | | 1.507  ± 0.070 | 0.452  ± 0.065 | | | 2.089  ± 0.080 | | 0.451  ± 0.059 | | | 0.570  ± 0.101 | | 0.353  ± 0.056 | | | 0.430  ± 0.043 | | |  | | 0.698  ± 0.014 | |
| HK  (I) | 0.442  ± 0.114 | 0.903  ± 0.041 | 0.479  ± 0.079 | | 0.874  ± 0.083 | 1.399  ± 0.117 | | 1.291  ± 0.071 | 0.551  ± 0.127 | | | 1.655  ± 0.100 | | 0.393  ± 0.038 | | | 0.571  ± 0.192 | | 0.331  ± 0.050 | | | 0.401  ± 0.072 | | | 0.264  ± 0.089 | | 0.407  ± 0.040 | |
| HK  (D) | 0.493  ± 0.082 | 0.830  ± 0.093 | 0.281  ± 0.024 | | 0.558  ± 0.027 | 0.660  ± 0.096 | | 0.785  ± 0.055 | 0.434  ± 0.059 | | | 1.279  ± 0.130 | | 0.387  ± 0.039 | | | 0.555  ± 0.063 | | 0.391  ± 0.069 | | | 0.486  ± 0.053 | | |  | | 0.425  ± 0.067 | |
| PK  (S) | 558.95  ± 30.44 | 565.24  ± 14.92 | 689.47  ± 26.66 | | 554.60  ± 14.84 | 361.09  ± 12.61 | | 483.95  ± 17.08 | 682.16  ± 26.22 | | | 524.42  ± 15.29 | | 677.11  ± 28.03 | | | 560.95  ± 12.84 | | 671.93  ± 34.62 | | | 378.27  ± 13.89 | | |  | | 469.77  ± 14.41 | |
| PK  (I) | 501.94  ± 29.78 | 476.95± 15.34 | 540.43  ± 21.81 | | 510.48  ± 15.93 | 339.09  ± 10.18 | | 392.00  ± 16.79 | 530.08  ± 16.39 | | | 430.99  ± 13.13 | | 554.63  ± 25.41 | | | 510.48  ± 15.93 | | 546.03  ± 42.05 | | | 249.26  ± 16.97 | | | 372.27  ± 32.40 | | 363.81  ± 5.93 | |
| PK  (D) | 413.41  ± 49.61 | 330.25  ± 13.43 | 468.79  ± 42.84 | | 401.44  ± 7.24 | 290.48  ± 8.55 | | 317.97  ± 16.07 | 532.99  ± 17.83 | | | 398.53  ± 10.19 | | 490.52  ± 28.02 | | | 436.27  ± 20.39 | | 421.92  ± 25.74 | | | 207.94  ± 15.00 | | |  | | 347.10  ± 8.32 | |
| LDH  (S) | 396.64  ± 20.93 | 368.38  ± 14.08 | 452.01  ± 21.69 | | 379.74  ± 21.82 | 556.93  ± 13.48 | | 267.23  ± 22.23 | 466.62  ± 38.90 | | | 312.53  ± 20.35 | | 525.48  ± 31.50 | | | 407.43  ± 12.94 | | 519.64  ± 32.13 | | | 352.66  ± 16.23 | | |  | | 289.58  ± 14.26 | |
| LDH  (I) | 315.22  ± 27.17 | 308.51  ± 10.12 | 337.72  ± 17.13 | | 307.04  ± 9.69 | 310.48  ± 15.93 | | 194.31  ± 16.02 | 359.76  ± 35.71 | | | 253.49  ± 6.69 | | 435.46  ± 32.46 | | | 332.08  ± 16.11 | | 394.62  ± 32.91 | | | 281.21  ± 12.20 | | | 379.27  ± 19.91 | | 257.09  ± 11.76 | |
| LDH  (D) | 270.71  ± 17.38 | 237.22  ± 10.70 | 288.98  ± 21.31 | | 228.91  ± 11.05 | 164.63  ± 5.75 | | 211.47  ± 14.37 | 264.92  ± 33.41 | | | 187.07  ± 6.18 | | 314.23  ± 29.22 | | | 259.15  ± 10.86 | | 264.11  ± 44.74 | | | 232.94  ± 13.73 | | |  | | 292.31  ± 14.04 | |
| ***Citric acid cycle*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| CS  (S) | 62.86  ± 5.99 | 74.35  ± 8.34 | 75.77  ± 4.28 | | 69.41  ± 5.42 | 127.31  ± 4.79 | | 101.38  ± 9.02 | 70.82  ± 7.12 | | | 82.17  ± 4.06 | | 52.69  ± 2.42 | | | 58.61  ± 3.88 | | 75.29  ± 3.12 | | | 86.13  ± 4.68 | | |  | | 62.24  ± 4.12 | |
| CS  (I) | 84.29  ± 5.44 | 101.65  ± 3.67 | 71.24  ± 3.41 | | 90.90  ± 3.13 | 86.50  ± 3.71 | | 86.92  ± 9.15 | 86.06  ± 5.59 | | | 103.22  ± 3.10 | | 95.78  ± 5.03 | | | 73.43  ± 3.46 | | 107.74  ± 4.71 | | | 106.59  ± 5.50 | | | 76.87  ± 4.87 | | 71.40  ± 2.60 | |
| CS  (D) | 100.25  ± 10.49 | 108.80  ± 4.94 | 81.02  ± 11.15 | | 90.91  ± 7.68 | 132.38  ± 4.44 | | 116.03  ± 9.48 | 94.49  ± 5.55 | | | 102.01  ± 5.37 | | 96.27  ± 10.46 | | | 64.75  ± 6.50 | | 78.02  ± 16.67 | | | 94.49  ± 9.10 | | |  | | 88.34  ± 4.50 | |
| IDH  (S) | 16.69  ± 1.15 | 19.87  ± 1.09 | 21.50  ± 0.52 | | 18.33  ± 1.41 | 17.46  ± 1.13 | | 17.68  ± 1.54 | 10.98  ± 0.63 | | | 17.83  ± 2.61 | | 18.19  ± 0.83 | | | 14.26  ± 0.53 | | 22.45  ± 0.70 | | | 18.00  ± 0.84 | | |  | | 18.06  ± 0.84 | |
| IDH  (I) | 21.21  ± 1.44 | 24.39  ± 0.91 | 23.13  ± 0.48 | | 23.16  ± 0.81 | 23.69  ± 3.05 | | 18.49  ± 2.24 | 14.43  ± 0.41 | | | 18.72  ± 2.23 | | 21.37  ± 0.63 | | | 17.29  ± 0.58 | | 23.84  ± 0.49 | | | 23.22  ± 0.48 | | | 26.41  ± 3.30 | | 23.52  ± 0.43 | |
| IDH  (D) | 24.62  ± 0.81 | 24.81  ± 1.25 | 23.81  ± 0.28 | | 23.83  ± 1.52 | 26.80  ± 0.57 | | 22.13  ± 1.23 | 21.61  ± 0.65 | | | 20.57  ± 0.91 | | 21.80  ± 0.53 | | | 19.84  ± 0.73 | | 25.16  ± 0.31 | | | 20.56  ± 0.86 | | |  | | 29.73  ± 0.95 | |
| MDH  (S) | 701.76  ± 38.96 | 808.69  ± 37.43 | 547.07  ± 65.37 | | 574.24  ± 91.46 | 616.35  ± 34.66 | | 721.10  ± 50.97 | 709.97  ± 41.80 | | | 700.67  ± 43.76 | | 624.44  ± 34.40 | | | 510.24  ± 38.39 | | 851.73  ± 52.24 | | | 687.81  ± 69.42 | | |  | | 670.42  ± 37.92 | |
| MDH  (I) | 746.65  ± 23.29 | 961.01  ± 68.77 | 855.41  ± 37.00 | | 737.10  ± 74.08 | 650.81  ± 42.82 | | 612.51  ± 75.20 | 778.40  ± 73.79 | | | 842.57  ± 37.59 | | 867.99  ± 40.18 | | | 675.15  ± 78.05 | | 917.49  ± 81.63 | | | 720.53  ± 76.88 | | | 957.75  ± 84.89 | | 812.59  ± 46.07 | |
| MDH  (D) | 897.52  ± 72.13 | 822.21  ± 32.08 | 1010.54  ± 70.97 | | 828.35  ± 114.36 | 728.51  ± 32.63 | | 738.67  ± 69.86 | 939.22  ± 61.70 | | | 854.05  ± 36.05 | | 945.53  ± 61.05 | | | 724.28  ± 120.20 | | 922.25  ± 106.79 | | | 689.58  ± 51.69 | | |  | | 863.83  ± 37.24 | |
| ***Electron transport chain*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| CI  (S) | 5.65  ± 1.00 | 4.29  ± 1.08 | 1.31  ± 0.28 | | 1.00  ± 0.20 | 1.24  ± 0.18 | | 1.98  ± 0.40 | 1.49  ± 0.34 | | | 2.85  ± 0.74 | | 3.48  ± 0.77 | | | 4.49  ± 0.62 | | 1.69  ± 0.61 | | | 1.42  ± 0.27 | | |  | | 1.85  ± 0.24 | |
| CI  (I) | 5.86  ± 0.60 | 5.66  ± 1.51 | 2.22  ± 0.83 | | 1.37  ± 0.24 | 1.29  ± 0.17 | | 2.36  ± 1.11 | 2.12  ± 0.67 | | | 4.26  ± 0.51 | | 3.23  ± 0.72 | | | 5.39  ± 0.71 | | 1.51  ± 0.49 | | | 2.07  ± 0.22 | | | 2.67  ± 0.85 | | 2.58  ± 0.16 | |
| CI  (D) | 6.22  ± 0.99 | 6.86  ± 0.79 | 1.84  ± 0.10 | | 1.43  ± 0.36 | 1.34  ± 0.24 | | 2.35  ± 0.47 | 2.11  ± 0.52 | | | 3.22  ± 0.22 | | 4.61  ± 0.93 | | | 6.05  ± 1.18 | | 1.52  ± 0.28 | | | 2.39  ± 0.26 | | |  | | 3.46  ± 0.14 | |
| CII  (S) | 2.94  ± 0.23 | 3.64  ± 0.32 | 3.88  ± 0.31 | | 4.36  ± 0.14 | 5.16  ± 0.18 | | 4.00  ± 0.29 | 4.56  ± 0.20 | | | 4.08  ± 0.13 | | 2.84  ± 0.08 | | | 3.30  ± 0.13 | | 3.07  ± 0.22 | | | 4.56  ± 0.22 | | |  | | 3.53  ± 0.16 | |
| CII  (I) | 3.57  ± 0.23 | 5.07  ± 0.18 | 5.36  ± 0.41 | | 5.27  ± 0.13 | 5.70  ± 0.17 | | 4.29  ± 0.10 | 4.51  ± 0.28 | | | 5.36  ± 0.14 | | 3.82  ± 0.26 | | | 4.26  ± 0.20 | | 3.71  ± 0.34 | | | 5.44  ± 0.32 | | | 3.61  ± 0.19 | | 3.89  ± 0.14 | |
| CII  (D) | 4.49  ± 0.12 | 4.84  ± 0.13 | 5.32  ± 0.28 | | 4.45  ± 0.12 | 5.17  ± 0.14 | | 4.42  ± 0.21 | 4.14  ± 0.34 | | | 5.85  ± 0.10 | | 4.31  ± 0.26 | | | 4.04  ± 0.34 | | 3.35  ± 0.30 | | | 5.26  ± 0.22 | | |  | | 4.57  ± 0.22 | |
| CIV  (S) | 34.02  ± 5.90 | 19.03  ± 1.85 | 58.55  ± 3.20 | | 19.77  ± 2.83 | 8.80  ± 0.88 | | 25.01  ± 5.56 | 54.43  ± 2.47 | | | 25.39  ± 3.83 | | 48.19  ± 2.43 | | | 17.97  ± 2.15 | | 53.27  ± 1.63 | | | 20.59  ± 1.72 | | |  | | 20.70  ± 3.13 | |
| CIV  (I) | 42.96  ± 8.07 | 28.95  ± 2.38 | 69.23  ± 3.48 | | 24.99  ± 2.93 | 11.59  ± 1.28 | | 29.20  ± 3.14 | 59.33  ± 1.97 | | | 29.97  ± 2.13 | | 58.89  ± 2.22 | | | 31.68  ± 4.02 | | 59.71  ± 1.49 | | | 24.43  ± 2.70 | | | 72.63  ± 5.64 | | 19.19  ± 2.27 | |
| CIV  (D) | 51.31  ± 9.03 | 28.64  ± 2.18 | 56.30  ± 3.03 | | 31.54  ± 4.23 | 11.92  ± 1.56 | | 26.75  ± 5.74 | 61.48  ± 1.38 | | | 24.47  ± 1.91 | | 60.69  ± 1.70 | | | 25.98  ± 3.55 | | 57.59  ± 2.28 | | | 33.57  ± 3.65 | | |  | | 25.29  ± 2.27 | |
| ATPsyn  (S) | 7.31  ± 1.47 | 11.32  ± 3.21 | 9.90  ± 2.85 | | 11.93  ± 4.33 | 11.75  ± 3.16 | | 8.28  ± 2.19 | 7.82  ± 1.64 | | | 16.74  ± 4.78 | | 11.46  ± 3.31 | | | 18.28  ± 2.98 | | 5.90  ± 1.06 | | | 22.99  ± 2.76 | | |  | | 23.53  ± 1.76 | |
| ATPsyn  (I) | 6.88  ± 1.57 | 10.05  ± 2.07 | 4.43  ± 1.06 | | 10.67  ± 2.81 | 11.87  ± 2.08 | | 8.32  ± 3.55 | 7.69  ± 1.34 | | | 13.94  ± 3.66 | | 6.83  ± 1.64 | | | 19.21  ± 5.60 | | 6.30  ± 1.36 | | | 18.07  ± 2.67 | | | 6.10  ± 2.50 | | 20.02  ± 2.19 | |
| ATPsyn  (D) | 10.74  ± 3.61 | 6.96  ± 2.64 | 9.61  ± 2.53 | | 10.42  ± 3.17 | 6.86  ± 1.42 | | 5.34  ± 1.36 | 5.29  ± 0.91 | | | 11.34  ± 3.65 | | 5.28  ± 1.06 | | | 11.28  ± 2.02 | | 7.77  ± 1.99 | | | 14.28  ± 3.20 | | |  | | 12.04  ± 2.15 | |
| ***Fatty acid metabolism*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| HOAD  (S) | 15.99  ± 1.14 | 18.76  ± 1.87 | 13.73  ± 1.13 | | 21.41  ± 1.78 | 50.52  ± 1.75 | | 28.36  ± 2.55 | 10.29  ± 0.81 | | | 15.33  ± 2.09 | | 12.84  ± 0.85 | | | 17.25  ± 1.15 | | 12.40  ± 0.78 | | | 15.53  ± 2.01 | | |  | | 13.07  ± 1.15 | |
| HOAD  (I) | 16.61  ± 1.96 | 25.44  ± 1.73 | 9.39  ± 1.51 | | 29.69  ± 0.95 | 50.41  ± 1.02 | | 28.58  ± 3.96 | 7.10  ± 0.51 | | | 17.96  ± 2.67 | | 11.20  ± 1.07 | | | 21.41  ± 1.04 | | 9.58  ± 0.64 | | | 17.96  ± 2.67 | | | 11.29  ± 0.53 | | 16.75  ± 1.30 | |
| HOAD  (D) | 10.20  ± 2.52 | 23.43  ± 1.27 | 11.47  ± 0.53 | | 23.02  ± 1.23 | 57.69  ± 0.80 | | 31.01  ± 1.80 | 8.12  ± 0.59 | | | 15.56  ± 0.86 | | 11.18  ± 0.77 | | | 19.37  ± 1.64 | | 13.25  ± 1.85 | | | 15.75  ± 0.97 | | |  | | 11.37  ± 2.24 | |
| ***Adenylate metabolism*** | | | | | | | | | | |  | |  | | |  | |  | | |  | |  | | |  | |  |
| AK  (S) | 228.52  ± 5.89 | 200.90  ± 6.49 | 221.54  ± 10.98 | | 265.82  ± 11.26 | 206.00  ± 6.37 | | 196.98  ± 12.89 | 304.16  ± 7.86 | | | 237.02  ± 7.05 | | 291.20  ± 7.19 | | | 304.65  ± 5.60 | | 273.93  ± 21.32 | | | 235.30  ± 4.90 | | |  | | 225.19  ± 5.66 | |
| AK  (I) | 211.383  ± 6.73 | 178.12  ± 7.45 | 228.93  ± 13.88 | | 280.38  ± 8.08 | 192.81  ± 10.97 | | 157.43  ± 9.52 | 258.16  ± 7.98 | | | 236.21  ± 8.43 | | 270.90  ± 9.81 | | | 290.34  ± 8.42 | | 257.36  ± 25.19 | | | 221.85  ± 5.58 | | | 296.86  ± 47.21 | | 217.51  ± 4.72 | |
| AK  (D) | 214.85  ± 23.14 | 169.73  ± 7.22 | 286.48  ± 18.84 | | 249.91  ± 12.93 | 142.77  ± 6.96 | | 166.79  ± 6.93 | 240.85  ± 8.28 | | | 249.33  ± 5.53 | | 245.21  ± 15.92 | | | 201.36  ± 11.85 | | 221.94  ± 14.64 | | | 246.04  ± 5.52 | | |  | | 254.59  ± 4.71 | |
| CK  (S) | 68.80  ± 2.49 | 33.46  ± 1.16 | 70.16  ± 7.37 | | 42.15  ± 3.55 | 63.51  ± 4.71 | | 35.01  ± 3.54 | 69.46  ± 5.99 | | | 36.16  ± 5.11 | | 64.57  ± 11.68 | | | 38.94  ± 4.76 | | 83.71  ± 9.61 | | | 49.47  ± 5.68 | | |  | | 12.39  ± 1.30 | |
| CK  (I) | 59.74  ± 6.83 | 32.67  ± 1.70 | 71.87  ± 5.38 | | 42.55  ± 6.37 | 61.75  ± 3.26 | | 20.49  ± 1.93 | 67.31  ± 1.36 | | | 22.03  ± 4.63 | | 61.06  ± 3.03 | | | 32.17  ± 2.54 | | 84.58  ± 5.75 | | | 40.58  ± 7.17 | | | 26.79  ± 1.17 | | 16.42  ± 1.63 | |
| CK  (D) | 68.23  ± 8.09 | 43.85  ± 2.21 | 72.32  ± 5.04 | | 44.17  ± 8.55 | 31.87  ± 5.26 | | 35.37  ± 9.76 | 64.27  ± 3.95 | | | 25.95  ± 4.75 | | 65.97  ± 7.54 | | | 26.19  ± 5.45 | | 62.93  ± 4.91 | | | 35.64  ± 4.48 | | |  | | 12.50  ± 3.06 | |

Values are given in as the mean ± SEM. List of abbreviations: HA = high altitude; LA = low altitude; S = tissue sampled from surface muscle; I = tissue sampled from intermediate muscle; D = tissue sampled from deep muscle; Mb = myoglobin; HK = hexokinase; PK = pyruvate kinase; LDH = lactate dehydrogenase; CS = citrate synthase; IDH = isocitrate dehydrogenase; MDH = malate dehydrogenase; CI = complex 1 (syn. NADH:ubiquinone oxidoreductase); CII = complex 2 (syn. succinate dehydrogenase); CIV = complex IV (syn. cytochrome c oxidase); ATPsyn = FOF1 ATP synthase; HOAD = 3-hydroxyacyl-CoA dehydrogenase; AK = adenylate kinase; and CK = creatine kinase.