**Supplementary material - Supplemental tables**

Oxidative costs of cooperation in cooperatively breeding Damaraland mole-rats

Rute Mendonça, Philippe Vullioud, Nathan Katlein, Armelle Vallat, Gaétan Glauser, Nigel C. Bennett, Fabrice Helfenstein

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Table S1 - Ethogram used for scan observations. The left side of the table shows how behaviours were grouped to form variables used in the statistical analyses.

|  |  |  |
| --- | --- | --- |
| Variables | Behaviour | Description |
| Activity | Food Carry | Food carry | Transporting of food pieces |
| Nest Build | Nest build | Preparing nest material for transport and transporting nest material  |
| Burrow | Dig | Excavating sand using incisors and front paws |
| Sweep | Moving sand backwards using hind legs |
| Kick | Compacting sand against tunnel using nose or hind legs |
| Locomotion work | Moving between bouts of all the above behaviours |
| Non-Cooperation | Locomotion | Moving unrelated with all the above behaviours |
| Sniff | Investigating objects with the nose |
| Eat | Ingesting food |
| Self-Groom | Hygiene maintenance behaviours directed to the actor's body |
| Social interaction | Any interaction with another individual |
| Pump  | Repetitive up and down movement of the body  |
| Gnaw | Chewing the plastic tunnels with incisors |
| Other | Any behaviour that cannot be assigned to the described behaviours |
| Rest |   | Rest | Sleeping in the nest or tunnels |
|   | Huddle | Resting in the tunnels in physical contact with at least one individual |

Table S2 - OLRE binomial GLMMs examining the effect of treatment on the percentage of time spent (a) active, (b) performing burrowing activities, and (c) performing non-cooperative activities, during 12h scan observations. Dataset included 308 observations, from 77 individuals belonging to 6 colonies. Reference levels of categorical fixed effects are: 1control; 2breeder; 3female; 4day2. Significant terms are shown in bold.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Estimate  | SE | χ2 | p-value | Estimate  | SE | χ2 | p-value | Estimate  | SE | χ2 | p-value |
| *Fixed effects* | *(a) Active* | *(b) Burrow* | *(c) Non-Cooperation* |
| Intercept | -1.04 | 0.17 |  |  | -3.00 | 0.32 |  |  | -1.39 | 0.13 |  |  |
| Treatment 1 | **0.46** | **0.18** | **38.75** | **< 0.001** | **0.95** | **0.30** | **209.09** | **< 0.001** | **0.12** | **0.15** | **23.63** | **< 0.001** |
| Body mass | -0.04 | 0.05 | 1.96 | 0.161 | 0.01 | 0.10 | < 0.01 | 0.974 | **-0.05** | **0.04** | **5.87** | **0.015** |
| Breeding Status 2 | 019 | 0.18 | 2.20 | 0.138 | 0.09 | 0.34 | 0.05 | 0.826 | **0.15** | **0.13** | **4.38** | **0.036** |
| Sex 3 | 0.25 | 0.20 | 2.26 | 0.133 | 0.56 | 0.38 | 1.45 | 0.229 | 0.11 | 0.14 | 0.23 | 0.613 |
| Day 4 | **-0.02** | **0.01** | **12.38** | **< 0.001** | **-0.03** | **0.02** | **4.19** | **0.041** | **-0.01** | **0.01** | **9.33** | **0.002** |
| Treatment \* Body mass | -0.04 | 0.05 | 0.47 | 0.492 | -0.02 | 0.09 | 0.04 | 0.844 | -0.05 | 0.04 | 1.52 | 0.218 |
| Treatment \* Status  | -0.07 | 0.17 | 0.94 | 0.333 | 0.14 | 0.30 | 2.83 | 0.093 | -0.17 | 0.15 | 0.09 | 0.762 |
| Treatment \* Sex  | -0.24 | 0.20 | < 0.01 | 0.981 | -0.18 | 0.33 | 0.11 | 0.745 | -0.36 | 0.17 | 1.50 | 0.220 |
| Status \* Sex | -0.16 | 0.22 | < 0.01 | 0.962 | -0.50 | 0.42 | 0.87 | 0.352 | -0.05 | 0.16 | 0.85 | 0.357 |
| Treatment \* Day | -0.03 | 0.02 | 0.27 | 0.132 | < 0.01 | 0.03 | < 0.01 | 0.995 | -0.02 | 0.02 | 2.17 | 0.141 |
| Treatment \* Status \* Sex | 0.30 | 0.22 | 1.83 | 0.176 | 0.29 | 0.37 | 0.61 | 0.436 | 0.34 | 0.19 | 3.31 | 0.069 |
| *Random effects* | Variance | SD |  |  | Variance | SD |  |  | Variance | SD |  |  |
| OLRE | 0.119 | 0.345 |  |  | 0.324 | 0.569 |  |  | 0.068 | 0.261 |  |  |
| Animal/Colony | 0.073 | 0.271 |  |  | 0.315 | 0.561 |  |  | 0.025 | 0.158 |  |  |
| Colony | 0.009 | 0.093 |  |  | < 0.001 | < 0.001 |  |  | 0.007 | 0.086 |  |  |

Table S3 –LMM examining the effect of treatment on weekly changes in body mass. Dataset included 132 observations, from 73 individuals belonging to 6 colonies. Reference levels of categorical fixed effects are: 1control; 2breeder; 3female.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Fixed effects* | Estimate  | SE | F | Df (N,D) | p-value |
| Intercept | 6.92 | 2.89 |  |  |  |
| Treatment 1 | -0.58 | 2.90 | 0.10 | 1,65 | 0.758 |
| Initial body mass | -0.02 | 0.02 | 1.68 | 1,73 | 0.199 |
| Breeding Status 2 | -2.03 | 2.06 | 0.76 | 1,63 | 0.387 |
| Sex 3 | -0.67 | 2.39 | 0.78 | 1,67 | 0.381 |
| Treatment \* Status  | 1.02 | 3.12 | 1.13 | 1,69 | 0.291 |
| Treatment \* Sex  | -2.14 | 3.55 | 0.24 | 1,65 | 0.625 |
| Status \* Sex | 0.31 | 2.70 | 0.26 | 1,65 | 0.612 |
| Treatment \* Status \* Sex | 1.70 | 3.98 | 0.18 | 1,69 | 0.672 |
| *Random effects* | Variance | SD |  |  |  |
| Animal/Colony | 0.94 | 0.97 |  |  |  |
| Colony | 0.81 | 0.90 |  |  |  |
| Residual | 19.84 | 4.46 |  |  |  |

Table S4 – LMMs examining the effect of treatment on final (Day 8) levels of (a) cellular oxidation GSSG/GSH, (b) oxidized glutathione GSSG and (c) reduced glutathione GSH, in erythrocytes. Dataset included 138 observations, from 74 individuals belonging to 6 colonies. Reference level of categorical fixed effects are: 1control; 2breeder; 3female. Significant terms are shown in bold.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value |
| *Fixed effects* | (a) GSSG/GSH | (b) GSSG | (c) GSH |
| Intercept | -3.97 | 0.24 |  |  |   | 2.89 | 0.23 |  |  |   | 6.86 | 0.05 |  |  |  |
| Treatment 1 | **0.17** | **0.26** | **5.26** | **1,63** | **0.025** | **0.12** | **0.29** | **9.43** | **1,65** | **0.003** | **0.03** | **0.07** | **24.74** | **1,64** | **< 0.001** |
| Breeding Status 2 | < 0.01 | 0.20 | 0.31 | 1,66 | 0.579 | -0.05 | 0.22 | 0.08 | 1,64 | 0.780 | -0.01 | 0.05 | 3.33 | 1,66 | 0.072 |
| Sex 3 | 0.10 | 0.22 | 0.28 | 1,68 | 0.596 | 0.08 | 0.24 | 0.65 | 1,68 | 0.424 | -0.06 | 0.06 | 0.38 | 1,69 | 0.539 |
| Body Mass | -0.05 | 0.06 | 0.02 | 1,76 | 0.893 | -0.07 | 0.07 | 0.42 | 1,77 | 0.521 | 0.01 | 0.01 | 1.20 | 1,61 | 0.27 |
| Initial marker level | **0.45** | **0.07** | **47.32** | **1,113** | **< 0.001** | **0.53** | **0.07** | **61.02** | **1,89** | **< 0.001** | **0.24** | **0.01** | **525.39** | **1,47** | **< 0.001** |
| Treatment \* Status | 0.02 | 0.28 | 0.15 | 1,66 | 0.698 | 0.24 | 0.32 | 0.57 | 1,67 | 0.453 | 0.07 | 0.08 | 0.26 | 1,69 | 0.611 |
| Treatment \* Sex  | -0.11 | 0.32 | 0.13 | 1,71 | 0.722 | -0.03 | 0.36 | 0.69 | 1,73 | 0.409 | 0.06 | 0.09 | < 0.01 | 1,72 | 1.000 |
| Status \* Sex | -0.14 | 0.25 | 0.29 | 1,70 | 0.591 | -0.09 | 0.27 | 0.49 | 1,69 | 0.485 | 0.07 | 0.07 | 0.46 | 1,72 | 0.501 |
| Treatment \* Body Mass | 0.11 | 0.08 | 1.76 | 1,78 | 0.189 | 0.17 | 0.09 | 3.50 | 1,79 | 0.065 | < 0.01 | 0.02 | < 0.01 | 1,73 | 1.000 |
| Treatment \* Initial marker level | -0.13 | 0.07 | 3.09 | 1,72 | 0.083 | -0.15 | 0.08 | 3.21 | 1,74 | 0.077 | 0.01 | 0.02 | 0.36 | 1,81 | 0.549 |
| Treatment \* Status \* Sex | 0.07 | 0.34 | 0.04 | 1,69 | 0.837 | -0.14 | 0.40 | 0.12 | 1,68 | 0.732 | -0.07 | 0.10 | 0.55 | 1,75 | 0.460 |
| *Random effects* | Variance | SD |  |  |   | Variance | SD |  |  |   | Variance | SD |  |  |  |
| Animal/Colony | 0.032 | 0.178 |   |   |   | < 0.001 | < 0.001 |   |   |   | < 0.001 | < 0.001 |   |   |   |
| Colony | 0.148 | 0.384 |  |  |   | 0.099 | 0.314 |  |  |   | < 0.001 | < 0.001 |  |  |  |
| Residual | 0.145 | 0.381 |   |   |   | 0.201 | 0.448 |   |   |   | 0.011 | 0.106 |   |   |   |

Table S5 - LMM examining the effect of treatment on final (Day 8) concentrations of (a) oxidative damage to lipids (MDA) in erythrocytes, (b) superoxide dismutase (SOD) antioxidant activity in erythrocytes and (c) MDA in plasma. Dataset for MDA erythrocytes included 138 observations from 73 individuals belonging to 6 colonies. Datasets for SOD and plasmatic MDA included 140 observations from 74 individuals belonging to 6 colonies. Reference level of categorical fixed effects are: 1control; 2breeder; 3female. Significant terms are shown in bold.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value |
| *Fixed effects* | (a) MDA erythrocytes | (b) SOD | (c) MDA plasma |
| Intercept | 8.57 | 0.05 |  |  |   | 6.49 | 0.13 |  |  |   | 3.55 | 0.07 |  |  |  |
| Treatment 1 | -0.17 | 0.07 | 1.22 | 1,64 | 0.273 | 0.05 | 0.10 | 0.06 | 1,62 | 0.804 | -0.12 | 0.09 | < 0.01 | 1,64 | 0.978 |
| Breeding Status 2 | -0.13 | 0.06 | 1.10 | 1,61 | 0.299 | 0.05 | 0.10 | 0.26 | 1,62 | 0.613 | -0.10 | 0.07 | 0.38 | 1,64 | 0.540 |
| Sex 3 | -0.14 | 0.06 | 0.46 | 1,66 | 0.500 | 0.04 | 0.11 | 1.28 | 1,68 | 0.262 | -0.14 | 0.08 | 0.19 | 1,67 | 0.667 |
| Body Mass | **-0.01** | **0.02** | **6.46** | **1,77** | **0.013** | -0.04 | 0.03 | 0.97 | 1,75 | 0.328 | < 0.01 | 0.02 | 0.17 | 1,77 | 0.681 |
| Initial marker level | **0.18** | **0.03** | **84.01** | **1,94** | **< 0.001** | **0.08** | **0.03** | **13.30** | **1,101** | **< 0.001** | **0.11** | **0.02** | **43.34** | **1,110** | **< 0.001** |
| Treatment \* Status | 0.13 | 0.08 | 0.78 | 1,65 | 0.379 | -0.07 | 0.11 | 0.54 | 1,62 | 0.465 | 0.11 | 0.10 | 0.85 | 1,66 | 0.359 |
| Treatment \* Sex  | **0.19** | **0.09** | **4.50** | **1,70** | **0.037** | < 0.01 | 0.13 | 0.06 | 1,68 | 0.812 | 0.13 | 0.11 | 1.43 | 1,71 | 0.235 |
| Status \* Sex | 0.14 | 0.07 | 1.89 | 1,65 | 0.174 | 0.01 | 0.12 | 0.02 | 1,64 | 0.878 | 0.16 | 0.09 | 2.99 | 1,64 | 0.089 |
| Treatment \* Body Mass | -0.04 | 0.02 | 2.41 | 1,78 | 0.125 | 0.03 | 0.03 | 0.66 | 1,70 | 0.421 | 0.01 | 0.03 | 0.08 | 1,76 | 0.778 |
| Treatment \* Initial marker level | < 0.01 | 0.03 | < 0.01 | 1,83 | 0.984 | -0.03 | 0.03 | 0.65 | 1,88 | 0.421 | -0.01 | 0.03 | 0.30 | 1,96 | 0.584 |
| Treatment \* Status \* Sex | -0.14 | 0.10 | 1.88 | 1,67 | 0.175 | 0.02 | 0.14 | 0.03 | 1,63 | 0.863 | -0.08 | 0.12 | 0.50 | 1,66 | 0.481 |
| *Random effects* | Variance | SD |  |  |   | Variance | SD |  |  |   | Variance | SD |  |  |  |
| Animal/Colony | 0.001 | 0.031 |   |   |   | 0.019 | 0.139 |   |   |   | 0.003 | 0.057 |   |   |   |
| Colony | 0.003 | 0.058 |  |  |   | 0.049 | 0.222 |  |  |   | 0.003 | 0.054 |  |  |  |
| Residual | 0.012 | 0.11 |   |   |   | 0.026 | 0.161 |   |   |   | 0.019 | 0.138 |   |   |   |

Table S6 - LMMs examining the effect of treatment on final (Day 8) levels of (a) superoxide dismutase (SOD) antioxidant activity and (b) oxidative damage to lipids (MDA), in ejaculates. Dataset for SOD included 51 observations, from 30 males belonging to 6 colonies. Dataset for MDA included 41 observations from 27 males belonging to 6 colonies. Reference level of categorical fixed effects are: 1control; 2breeder. Significant terms are shown in bold.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value |
| *Fixed effects* | (a) SOD | (b) MDA |
| Intercept | 2.92 | 0.77 |  |  |  | 8.17 | 0.93 |  |  |  |
| Treatment 1 | **0.88** | **0.32** | **7.15** | **1,24** | **0.013** | **1.00** | **0.44** | **4.82** | **1,20** | **0.040** |
| Breeding Status 2 | 0.54 | 0.33 | 0.69 | 1,23 | 0.413 | 0.76 | 0.41 | 1.83 | 1,20 | 0.191 |
| Body Mass | < 0.01 | < 0.01 | < 0.01 | 1,27 | 0.952 | < 0.01 | 0.01 | 0.36 | 1,25 | 0.554 |
| Treatment \* Breeding status | -0.57 | 0.39 | 2.03 | 1,24 | 0.168 | -0.65 | 0.53 | 1.39 | 1,21 | 0.251 |
| *Random effects* | Variance | SD |  |  |  | Variance | SD |  |  |  |
| Animal/Colony | 0.083 | 0.289 |   |   |   | 0.016 | 0.128 |   |   |   |
| Colony | 0.014 | 0.117 |  |  |  | < 0.001 | < 0.001 |  |  |  |
| Residual | 0.402 | 0.634 |   |   |   | 0.547 | 0.739 |   |   |   |

Table S7 - LMMs examining the effect of treatment on the final (Day 8) ratio germline/soma of (a) superoxide dismutase (SOD) antioxidant activity and (b) oxidative damage to lipids (MDA). Dataset for SOD included 51 observations, from 30 males belonging to 6 colonies. Dataset for MDA included 41 observations from 27 males belonging to 6 colonies. Reference level of categorical fixed effects are: 1control; 2breeder. Significant terms are shown in bold.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value |
| *Fixed effects* | (a) SOD | (b) MDA |
| Intercept | -4.09 | 0.80 |  |  |  | -0.85 | 0.90 |  |  |  |
| Treatment 1 | **0.78** | **0.30** | **5.97** | **1,23** | **0.023** | **1.09** | **0.43** | **5.15** | **1,20** | **0.034** |
| Breeding Status 2 | 0.50 | 0.34 | 0.47 | 1,24 | 0.501 | 0.78 | 0.40 | 1.44 | 1,20 | 0.244 |
| Body Mass | < 0.01 | < 0.01 | 0.62 | 1,26 | 0.437 | < 0.01 | 0.01 | 0.01 | 1,25 | 0.916 |
| Treatment \* Breeding status | -0.53 | 0.37 | 2.03 | 1,23 | 0.168 | -0.77 | 0.52 | 2.04 | 1,21 | 0.167 |
| *Random effects* | Variance | SD |  |  |  | Variance | SD |  |  |  |
| Animal/Colony | 0.175 | 0.418 |   |   |   | < 0.001 | < 0.001 |   |   |   |
| Colony | < 0.001 | < 0.001 |  |  |  | < 0.001 | < 0.001 |  |  |  |
| Residual | 0.343 | 0.586 |   |   |   | 0.533 | 0.73 |   |   |   |

Table S8 - LMMs examining whether initial levels of (a) GSSG/GSH, (b) GSSG, (c) and GSH in erythrocytes predicted changes in the percentage of burrowing (from the control to the sand treatment). Datasets included 70 observations, from 70 individuals belonging to 6 colonies. Reference levels of categorical fixed effects are: 1female; 2breeder.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value |
| *Fixed effects* | (a) GSSG/GSH | (b) GSSG | (c) GSH |
| Intercept | 10.55 | 5.79 |  |  |  | 10.35 | 5.83 |  |  |  | 10.22 | 6.03 |  |  |  |
| Initial concentration | 1.71 | 3.79 | 0.01 | 1,25 | 0.909 | 1.46 | 4.02 | 0.15 | 1,30 | 0.700 | -0.22 | 3.44 | 0.11 | 1,36 | 0.740 |
| Sex 1 | 2.33 | 4.04 | 2.61 | 1,56 | 0.112 | 2.27 | 4.08 | 2.50 | 1,56 | 0.119 | 1.39 | 4.01 | 2.32 | 1,57 | 0.133 |
| Breeding Status 2 | 3.51 | 3.54 | 2.99 | 1,57 | 0.089 | 3.52 | 3.60 | 2.98 | 1,57 | 0.090 | 3.06 | 3.48 | 2.97 | 1,56 | 0.090 |
| Body Mass | -0.01 | 0.03 | 0.12 | 1,60 | 0.725 | -0.01 | 0.03 | 0.11 | 1,60 | 0.745 | -0.01 | 0.03 | 0.04 | 1,60 | 0.840 |
| Control Burrow  | **-0.79** | **0.18** | **17.62** | **1,60** | **< 0.001** | **-0.78** | **0.18** | **16.65** | **1,60** | **< 0.001** | **-0.75** | **0.19** | **15.03** | **1,59** | **< 0.001** |
| Initial concentration \* Sex | -4.25 | 4.51 | 0.28 | 1,60 | 0.598 | -3.81 | 4.76 | 0.21 | 1,59 | 0.649 | 1.72 | 4.03 | 0.03 | 1,57 | 0.868 |
| Initial concentration \* Status | -1.53 | 3.99 | 0.18 | 1,60 | 0.676 | -1.64 | 4.23 | 0.08 | 1,59 | 0.773 | -0.55 | 3.67 | 0.48 | 1,59 | 0.490 |
| Sex \* Status | 0.81 | 4.44 | 0.10 | 1,56 | 0.758 | 0.81 | 4.48 | 0.10 | 1,56 | 0.756 | 1.66 | 4.38 | 0.12 | 1,56 | 0.729 |
| Initial concentration \* Sex \* Status | 3.89 | 4.94 | 0.60 | 1,59 | 0.440 | 3.45 | 5.16 | 0.43 | 1,59 | 0.515 | -1.76 | 4.47 | 0.15 | 1,56 | 0.696 |
| *Random effects* | Variance | SD |  |  |  | Variance | SD |  |  |  | Variance | SD |  |  |  |
| Colony | 5.198 | 2.28 |   |   |   | 4.644 | 2.155 |   |   |   | 5.263 | 2.294 |   |   |   |
| Residual | 49.196 | 7.014 |  |  |  | 49.606 | 7.043 |  |  |  | 49.456 | 7.033 |  |  |  |

Table S9 - LMMs examining whether initial levels of (a) SOD erythrocytes, (b) MDA erythrocytes, and (c) MDA plasma, predicted changes in the percentage of burrowing (from the control to the sand treatment). Datasets included 70 observations, from 70 individuals belonging to 6 colonies, except for (c), which included 69 observations. Reference levels of categorical fixed effects are: 1female; 2breeder.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value | Estimate  | SE | F | Df (N,D) | p-value |
| *Fixed effects* | (a) SOD | (b) MDA erythrocytes | (c) MDA plasma |
| Intercept | 11.62 | 5.84 |  |  |  | 11.84 | 6.06 |  |  |  | 12.03 | 5.69 |  |  |  |
| Initial concentration | 0.66 | 3.62 | 0.06 | 1,45 | 0.809 | 4.41 | 8.01 | 0.25 | 1,50 | 0.618 | 1.11 | 3.76 | 0.77 | 1,32 | 0.388 |
| Sex 1 | 1.61 | 4.05 | 2.42 | 1,57 | 0.125 | -0.33 | 4.99 | 2.54 | 1,56 | 0.117 | 1.94 | 3.91 | 2.06 | 1,55 | 0.157 |
| Breeding Status 2 | 2.87 | 3.52 | 2.75 | 1,57 | 0.103 | 1.54 | 4.45 | 2.89 | 1,56 | 0.095 | 3.21 | 3.40 | 3.31 | 1,55 | 0.074 |
| Body Mass | -0.02 | 0.03 | 0.23 | 1,60 | 0.631 | -0.01 | 0.03 | 0.05 | 1,60 | 0.821 | -0.02 | 0.30 | 0.32 | 1,58 | 0.574 |
| Control Burrow  | **-0.77** | **0.18** | **16.52** | **1,60** | **< 0.001** | **-0.76** | **0.19** | **15.38** | **1,58** | **< 0.001** | **-0.86** | **0.18** | **20.55** | **1,59** | **< 0.001** |
| Initial concentration \* Sex | -1.82 | 4.25 | 1.15 | 1,59 | 0.288 | -2.70 | 8.24 | 2.28 | 1,57 | 0.137 | 0.01 | 4.23 | 1.27 | 1,57 | 0.264 |
| Initial concentration \* Status | 0.65 | 3.84 | 0.05 | 1,56 | 0.826 | -2.87 | 8.10 | 1.17 | 1,58 | 0.284 | 0.83 | 3.92 | 0.21 | 1,58 | 0.650 |
| Sex \* Status | 1.59 | 4.43 | 0.14 | 1,56 | 0.715 | 3.48 | 5.28 | 0.61 | 1,56 | 0.439 | 1.16 | 4.28 | 0.03 | 1,54 | 0.870 |
| Initial concentration \* Sex \* Status | -0.22 | 4.69 | < 0.01 | 1,58 | 0.963 | -0.14 | 8.41 | < 0.01 | 1,57 | 0.987 | -3.34 | 4.93 | 0.45 | 1,55 | 0.503 |
| *Random effects* | Variance | SD |  |  |  | Variance | SD |  |  |  | Variance | SD |  |  |  |
| Colony | 3.197 | 1.788 |   |   |   | 6.972 | 2.64 |   |   |   | 9.992 | 3.161 |   |   |   |
| Residual | 49.984 | 7.07 |  |  |  | 47.314 | 6.878 |  |  |  | 45.721 | 6.762 |  |  |  |