**Costs and drivers of helminth parasite infection in wild female baboons**

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**Supplementary methods**

*Identifying and counting helminths.* Helminth identifications relied on parasite egg, larvae, cyst coloration, shape, contents, and size (Gillespie, 2006). Helminth egg counts were carried out using floatation (2 slides counted per sample) and sedimentation (5 slides per sample) techniques adapted from Gillespie (2006). Prior to analysis, each sample was thoroughly homogenized to ensure a uniform distribution of parasite eggs in the sample. Table S1 in Habig et al (in review) lists the helminth taxa commonly occurring in this population and their life history traits.

*Fecal floatation:* We suspended 4 g of each fecal sample in 12 ml of water in a 15ml centrifuge tube. The tube was centrifuged at 1500 rpm for 10 minutes, and the supernatant was discarded before re-suspending the sample in saturated sugar solution (specific gravity 1.27), forming a bulging meniscus at the top of the tube. A coverslip was placed on the meniscus, and the tube was centrifuged at 1500 rpm for 10 minutes to collect parasite eggs under the coverslip. The coverslip was placed on a microscope slide, and the procedure was repeated with the same sample using a second coverslip. Both coverslips were examined systematically at 10X magnification to count all visible parasite egg morphotypes.

*Fecal sedimentation:* We also suspended 4 g of each fecal sample in 12 ml of water in a 15 ml centrifuge tube and centrifuged at 1500 rpm for 10 minutes. After discarding the supernatant, we added 750ul of water and 500ul of saturated sugar solution and examined five drops of sediment under five separate coverslips, systematically scanning each coverslip at 10X magnification.

**Table S1**. Predictors of helminth infection from 32 previous studies of wild primates. Because our study focused on predictors of helminth burdens in females, we excluded four studies that examined only males (Arlet et al., 2015; Gillespie et al., 2013; Muehlenbein, 2006; Muehlenbein and Watts, 2010). We report results on female trends for the studies that analyzed males and females separately; otherwise we report general trends reported in both sexes.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Authors** | **Sex of the subjects** | **Species** | **Parasites** | **Social status** | **Reproductive state** | **Age** | **Group size** | **Rainfall**  **/season** | **Temperature**  **/season** | **GCs** | **Other predictors examined** |
| Benavides et al., (2012) | Both | Baboons (chacma) | Richness | None | NA | Convex | NA | (+) | (+) | NA | Sex, physical condition and range behaviour |
| Müller-Graf et al., (1996) | Both | Baboons (Olive) | Nematodes | None | L>C and P | (-) | NA | NA | NA | NA | Sex, troop differences |
| Ryan et al., (2012) | Both | Baboons (Olive) | Nematodes, Protozoa | NA | NA | NA | NA | (+) | (-) | NA | NA |
| Hausfater and Watson, (1976) | Both | Baboons (Yellow) | Nematodes | None | C>P | (+) | NA | NA | NA | NA | Sex |
| Meade, (1983) | Both | Baboons (Yellow) | Nematodes | None | P>C and L, C>L | None | NA | (-) | None | NA | N/A |
| Mc Grew et al (1989) | Both | Baboons Chimpanzees | Nematodes Cestodes Trematodes | NA | NA | NA | (+) | None | None | NA | Habitat, species |
| Parr et al., (2013) | Both | Capuchins (White-faced) | Nematodes Richness | None | NA | (+) | NA | (-) | NA | NA | Sex, habitat, range size |
| Gillespie et al., (2010) | Both | Chimpanzees | Nematodes Richness | NA | NA | (+) | NA | (+) | NA | NA | Sex, Habitat |
| Huffman et al., 1(997) | Both | Chimpanzees | Nematodes Protozoa | NA | NA | NA | NA | (+) | NA | NA | Diet |
| Lilly et al., (2002) | Both | Chimpanzees Gorillas Mangabeys, | Nematodes Protozoa | NA | NA | (-) | NA | None | NA | NA | Sex, habitat, species |
| Gillespie et al., (2005) | Both | Colobus | Nematodes Protozoa | NA | NA | None | NA | None | NA | NA | Sex |
| Chapman et al., (2007) | Both | Colobus (Red) | Nematodes | NA | NA | NA | None | NA | NA | None | Habitat, diet |

**Key: (+)- positive association, (-) = negative association, None=no association, NA=predictor not in the study, P=pregnant, L=Lactating, C=cycling, NL= non lactating, \*= effect observed in at least one parasite one parasite species.**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Authors** | **Sex of the subjects** | **Species** | **Parasites** | **Social status** | **Reproductive state** | **Age** | **Group size** | **Rainfall**  **/season** | **Temperature /season** | **GCs** | **Other predictors examined** |
| Chapman et al., (2010) | Both | Colobus (Red) | Nematodes | NA | NA | NA | NA | (+) | NA | NA | Habitat |
| Chapman et al., (2006) | Both | Colobus (Red) | Nematodes | NA | NA | NA | (-) | NA | NA | (+) | Habitat, diet |
| Snaith et al., (2008) | Both | Colobus (Red) | Nematodes Richness | NA | NA | NA | (-) | NA | NA | NA | NA |
| Rothman et al., (2008) | Both | Gorillas | Nematodes | None | NA | (+) | NA | (+)\* | NA | NA | Sex |
| Foerster et al., (2015) | Females | Guenons | Nematodes | (-) | L>NL | NA | NA | NA | NA | None | Diet |
| Gillespie et al. (2004) | Both | Guenons (Red-tailed ) | Nematodes | NA | NA | (+) | NA | None | NA | NA | Sex |
| Trejo-Macías et al., (2007) | Both | Howler monkeys | Nematodes | NA | NA | (+) | (+) | NA | NA | NA | NA |
| Martinez-Mota , (2015) | Both | Howler monkeys (black) | Nematodes Richness | NA | None | (+) | None | (-) | NA | None | Habitat |
| Stuart et al., (1990) | Both | Howler monkeys (mantled) | Nematodes | NA | NA | NA | (+) | NA | NA | NA | NA |
| Hämäläinen et al., (2015) | Both | Lemur (Gray mouse) | Nematodes Cestodes Trematodes Richness | NA | NA | (-) | NA | (-) | NA | NA | Sex, body and sample masses, year |
| Springer and Kappeler, (2016) | Both | Lemurs (multiple species) | Nematodes | NA | NA | NA | NA | (-) | NA | NA | Sex and body mass |
| Clough et al., (2010) | Both | Lemurs (Red-fronted) | Nematodes Richness | None | NA | (+) | (+) | NA | NA | (+) | Sex, mating, reproductive success year |
| Horii et al., (1982) | Both | Macaques (Japanese ) | Nematodes, Cestodes | NA | NA | None | NA | Summer/winter | NA | NA | Body weight |
| MacIntosh et al., (2010) | Both | Macaques (Japanese) | Nematodes | NA | Birth | Concave Convex | NA | Spring/summer | (+) | NA | Sex |
| MacIntosh et al., (2012) | Females | Macaques (Japanese) | Nematodes Richness | (+)\* | NA | (-)\* | NA | Fall/Spring | (+) | NA | Social network indices |

**Key: (+)- positive association, (-) = negative association, None=no association, NA=predictor not in the study, P=pregnant, L=Lactating, C=cycling, NL= non lactating, \*= effect observed in at least one parasite one parasite species.**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Authors** | **Year** | **Sex of the subjects** | **Species** | **Parasites** | **Social status** | **Reproductive state** | **Age** | **Group size** | **Rainfall**  **/season** | **Temperature**  **/season** | **GCs** | **Other predictors examined** |
| Gotoh, (2000) | 2000 | Both | Macaques (Japanese) | Nematodes Richness | NA | NA | (-) | NA | NA | (+) | NA | Sex, habitat |
| Setchell et al., (2007) | 2007 | Both | Mandrills | Nematodes Protozoa | None | P>C and L | (+) | NA | (+) | NA | NA | NA |
| Poirotte et al., (2016) | 2016 | Both | Mandrills Sphinx | Nematodes Protozoa  Richness | None | None | None | NA | (-) | (-) | NA | Sex |
| Stuart et al. , (1993) | 1993 | Both | Muriquis | Nematodes | NA | NA | NA | (-) | NA | NA | NA | NA |
| Gaetano, (2012) | 2013 | Both | Vervets | Nematodes | NA | NA | None | NA | (+) | (+) | NA | Sex, habitat |

**Key: (+)- positive association, (-) = negative association, None=no association, NA=predictor not in the study, P=pregnant, L=Lactating, C=cycling, NL= non lactating, \*= effect observed in at least one parasite one parasite species.**

**Table S2.** Summary of the predictors and results in Table S1.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Effects** | **Social status** | **Reproductive state** | **Age** | **Group size** | **Rainfall/Season** | **Temp** | **GCs** |
| Number of studies | 11 | 8 | 21 | 9 | 21 | 9 | 5 |
| Number of + effects | 1 | P/L > C = 4 | 9 | 4 | 8 | 5 | 2 |
| Number of - effects | 1 | C>L = 1 | 5 | 3 | 6 | 2 | 0 |
| Number of no effects | 9 | 2 | 5 | 2 | 4 | 2 | 3 |
| Other effects |  | 1 | 2 |  | 3 |  |  |

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