**Article title:** Costs of reproduction in a long-lived female primate: injury risk and wound healing

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**SUPPLEMENTARY METHODS**

**Measuring predictor variables**

Our goals were to test whether the incidence of injury and healing rates were predicted by female reproductive state and several other variables. These variables included: (1) the female’s age at the time she was injured, (2) her dominance rank at the time she was injured, (3) her group size, used as a measure of density and competition for resources, (4) whether she lived in a wild-feeding group or in a group that foraged part-time at the refuse pit of a nearby tourist lodge, (5) whether the female's social group was experiencing a permanent group fission, and (6) the season in which the injury was observed. Here we describe data collection on each of these variables.

Reproductive state. For most analyses, females were assigned to one of three reproductive states: ovarian cycling, pregnancy, or lactation. However in one analysis, we also tested whether cycling females experienced the highest risk of injury during the putative period of ovulation in each cycle, termed the peri-ovulatory period (Gesquiere et al. 2007). Data on each female’s reproductive state were recorded on each observation day, based on the color of her paracallosal skin, characteristics of her sexual swelling (e.g., turgescent vs. deturgescent and visual estimates of swelling size), and the presence of menstrual bleeding. This near-daily tracking of each female’s changes in reproductive status allowed us to assign reproductive state on the day she was seen injured with high confidence. C*ycling females* were those with black paracallosal skin that experienced regular monthly ovarian cycles, including sexual swelling and menstrual bleeding. The length of time spend in the cycling phase varies among females; nulliparous females typically experience cycles for a year or more before becoming pregnant, while older females may cycle 3 to 5 times before becoming pregnant (each ovarian cycle requires approximately 34 days (Altmann 1983)). Among cycling females, *peri-ovulatory females* were those in the five-day period prior to deturgescence of their sexual swellings, which is the most likely period of ovulation (Wildt et al. 1977; Shaikh et al. 1982; Gesquiere et al. 2007). For instance, in a laboratory study of 55 female baboons, the number of days to the first sign of deturgescence after ovulation was 2.07 (range = 1 to 5) (Shaikh et al. 1982). *Pregnant females* were identified using methods described previously (Altmann 1973; Beehner et al. 2006). The likely conception date for each pregnancy was calculated using observations of the female’s last sexual swelling. Pregnancy ended at birth or fetal loss (Beehner et al. 2006). *Lactating females* were those who had not yet resumed cycling after their most recent live birth, and whose infant was still alive. In the case of surviving infants, postpartum amenorrhea lasted approximately 12 to 18 months, at which time females resumed cycling.

Age. Females were considered to be adult when they attained menarche. 93% of the females in this study (215 of 231) were born after our studies of their group began, and so we knew their birth dates to within a few days and could calculate their ages accordingly. The remaining 16 females were born prior to the initiation of observations, and so their ages were estimated. Most had ages that were estimated to be accurate within 1 year (N = 9), and the remaining had ages estimated to within two years (N = 2), three years (N = 4), or four years (N = 1).

Dominance rank. Dominance ranks were assigned on a monthly basis using agonistic interactions recorded as part of regular observation visits. Ranks were determined by assigning wins and losses in dyadic agonistic interactions between females. Females "won" agonistic encounters when they gave only aggressive or neutral gestures in an encounter, and their opponent gave only submissive gestures (Hausfater 1975). We used these wins and losses to construct dominance matrices where each female was assigned an ordinal rank ranging from one (the highest rank) to n, where n was the number of adult females in the female's group. In modeling the effects of dominance rank, we used both ordinal and proportional dominance ranks. Proportional ranks (sometimes called relative ranks) are commonly used in the literature to address the problem that ordinal rank is somewhat collinear with group size (i.e. the lowest ordinal ranks can only occur in the largest groups). Proportional dominance rank was calculated as a female’s ordinal rank divided by the number of adult females in the group. Proportional ranks range from near zero to one, with high-ranking females holding the smallest proportional ranks (e.g. ordinal rank 1 in a group of 10 represents a proportional rank of 0.1). Proportional ranks reflect the percentile of a female’s ordinal rank; a female with a proportional rank of 0.9 is in the bottom 90% of ordinal ranks in her group.

Group size and type. We tested whether two aspects of females’ social groups influenced healing rates. First, we tested whether group size, measured as the number of adult males and females present in the group, created a density effect. Group size is known from near-daily censuses of all group members conducted during each observation visit. Between 1982 and 2011, group size ranged from 5 to 51 adult males and females (mean = 28.3 adults, median = 29 adults). Second, 14% of the injuries were observed in females living in a group that was not fully wild-feeding and instead sometimes foraged at a refuse site at a nearby tourist lodge. Because this supplemented feeding might influence healing rates, we also included feeding regime (wild-feeding or lodge-feeding) in our models of healing rates.

Group fission. Since 1982, six study groups in our population have experienced natural, permanent fission events, where the group divided from one stable social group into two groups (Van Horn et al. 2007). Fissions are sometimes accompanied by high rates of conflict and may lead to injuries. The six fission events varied in duration from one month to three years. We considered a fission event to begin when adult female group-mates foraged and slept repeatedly as subgroups in separate groves of trees. Fissions were considered complete when these subgroups ceased to forage or sleep together, and instead foraged and slept as independent groups (Van Horn et al. 2007).

Season. Season can influence wound healing (Martin et al. 2008). Amboseli experiences a predictable, five-month dry season from June through October when the ecosystem receives no rain and when food and water are relatively scarce. In the remaining seven months of the year (November through May), the ecosystem receives highly variable amounts of rain. The yearly average is 350 mm, but the range is 141-757 mm, and any given month or set of months in the “wet” season may experience no rain. We tested whether these seasons predicted healing rates by comparing injuries received in the dry season to those during the wetter season.

**Testing for observer bias or differences in injury severity**

In the course of our study, we found that reproductive state (lactation) significantly predicted healing rates (see Results). We wanted to exclude the possibility that observer bias could explain this result, which might arise if, for some reason, observers monitored injuries in lactating females less than other females. We tested this idea by using ANOVA to compare the log-transformed rate of observations (number of times a given injury was monitored per days to heal) as a function of female reproductive state. We found no significant differences in the rate at which observers updated the injury records for lactating, cycling or pregnant females (N = 501, F ratio = 0.28, P = 0.754).

Furthermore, although we were able to control for differences in healing rates across injury types, we could not control for differences in injury severity. This is important because if some females receive more severe injuries than others, they might require more time to recover. We used two methods to test for differences in injury severity across females in different reproductive states. First, we used an ANOVA to test whether reproductive state predicted injury size. Second, we used a chi square test to determine whether reproductive state predicted the probability that the injury impaired locomotion, assuming that more severe injuries would be more likely to impair movement. We found no evidence for these effects in our data set (see Results).

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