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The Effects of Maternal Rank has on Infant Outcomes

Amani Lee
Spelman College

The Relationship between Maternal Rank and Infant Behaviors: An Examination of Green Monkeys in Barbados

Amani Lee, Kelsey Kenniel, Katelyn Williams and Kai McCormack PhD

Spelman College, Atlanta GA

INTRODUCTION

Maternal characteristics and their relationship with infant outcomes have been investigated in many species, including primates. The rank of an animal is determined by how dominant an individual is in their group. Social rank is often defined in three categories: high, medium, and low (Kutsukake, 2000). In primates, rank varies between females and males.

In this study we investigated the association between maternal rank and the affiliative, agonistic, solitary, and anxiety behaviors of infant green monkeys (*Chloreocebus sabaeus*).

The hypothesis that was studied was the higher a mother's rank, the more affiliative behavior infant's will display, and the less solitary and agonistic behavior infants will display. This will be due to infants of higher ranking mothers being provided with more opportunities to interact and be social with others without their well-being being at risk.

METHODS

Study Design:

This was a naturalistic observational study that took place for 4 weeks in the month of June. Observations were conducted Monday through Friday between the hours of 12pm and 4pm, and did not take place during times of rain. During this time, researchers were also able to view monkeys exploring and interacting with each other. Each mother-infant pair was observed via continuous recording for an approximate duration of 5 hours total for each pair.

Subjects:

Four mother- infant pairs were observed in a free-ranging troop of approximately 20 green monkeys (*Chlorocebus sabaeus*) housed at the Barbados Wildlife Reserve Center. All infants were male and had been born during the month of June, ranging from one to four weeks of age.

Materials:

Prior to the research study, researchers developed an ethogram that listed all variables of interest, their codes names, and detailed operational definitions as seen in Table 1. Maternal rank was determined by a food displacement task. This consisted of throwing seeds when two or more mothers were present, and noting which mother approached food first, and/or caused another mother to flee. Notation of each displacement took place until each adult had been paired with each other. The adults were then classified as one or two, signifying high or low, respectively.

Pencil and paper check sheets were used to document observed behaviors. A watch was used for timing 10 minute durations of observation for each mother-infant pair. Binoculars were used to observe mother-infant pairs when they were too far out of the observer's range of view. Sunflower seeds were also used to lure in subjects and to occasionally observe displacement between mothers for ranking purposes. A master spreadsheet was updated daily by transferring the pencil and paper observations to a computer file.

METHODS cont'd

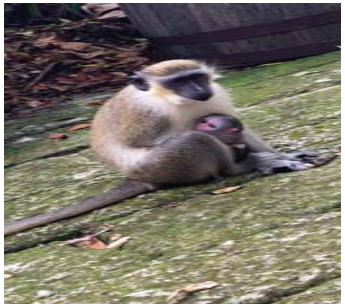
Table 1. Ethogram of infant behavior (adapted from by Rosenblum, & Paully, 1984; Bardi & Huffman, 2005)

Infant IV	Behavior	Code	Behavior Description
Affiliative		Contact (CT) Social Play (SP)	Infant touches others for at least three seconds (non-grooming) (C); Infant is wrestling, nipping, running after others (SC)
Agonistic	Stress (Displacement Activities)	Slap (S) Bite (B) Threat (T) Lunge (L) Chase (CH)	Use hand to hit others (S); Use teeth/gums or mouth to make contact with others (B); Open mouth threats to others (T); using head and feet to threaten others (L); Running after others (CH)
Solitary	Solitary Play	Exploration (EX)	Roaming and playing with objects alone (EX)
	Stress	Yawning (YI) Scratching (STI) Geckering (GKI) Body Shake (BSI)	Opens mouth and takes in air (YI), Uses hand and fingers to rub part of body (STI), Throaty noise (GKI), Shivering of the body (BSI)
	Passive	Sitting (SA)	Sitting alone

Procedure:

The first week of June consisted of defining and narrowing down independent and dependent variables. Dependent variables consisted of 3 combined scores of infant affiliative, agonistic, and solitary behavior. Independent variable was maternal rank. These variables were obtained through review of other primate studies and their respective ethograms. Preliminary observations also took place during the first week. During this time, researchers practiced identifying variables on their ethogram and made changes when necessary. Researchers also used the first week to solidify interobserver reliability (which was at 80% agreement), and to become acquainted with their subjects. From this, researchers solidified behaviors of interest and learned more about the subjects and their environment.

During the last three weeks, monkeys were opportunistically observed via focal sampling daily during the late-morning to mid-afternoon hours for approximately three to four hours a day. Throughout the study the behavioral data was collected by three observers. At the beginning of each observation day, all three researchers would collectively observe a mother-infant pair for a duration of ten minutes with a watch, checksheet, and binoculars. In the event that another mother-infant pair approached, one researcher would branch off and observe the new mother- infant pair. This was done to maximize data collection. If a mother-infant pair left the researcher's range of view, the time of observation was recorded, and continued only if the mother-infant pair returned to the researcher's range of view.



RESULTS

Data Analysis:

The data collection process consisted of gathering a total of 20 hours of data collection. There was a total of 4 mother-infant pairs in which approximately 5 hours were documented for each pair.

Descriptive statistics including means and standard deviations were obtained to better understand the demographics of the subjects. Furthermore, a series of analyses were conducted to examine relationships and mean differences of variables of interest.

An independent samples t- test was used to determine mean differences between high and low ranking mothers on infant agonistic, affiliative, and solitary behaviors.

Findings:

In the analysis to determine whether infant behavior differed based on maternal rank, no significant difference was found for either infant affiliative, agonistic, or solitary behaviors.

There was a trend toward significance for infant anxiety, with infants of low ranking mothers (M= .2606, SD= .0099) demonstrating higher rates of anxiety compared to infants of high ranking (M=.1193, SD= .0568), $t(2)= 3.463$, p= .074.

The effect size for each variable were large meaning the values were above .8.

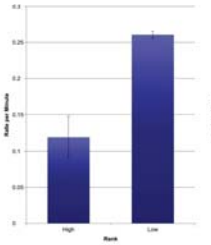


Figure 2a: Differences in anxiety levels between infants of high ranking mothers (M=.1193, SD= .0568) and low ranking mothers (M= .2606, SD= .0099), $t(2)= 3.463$, p= .074.

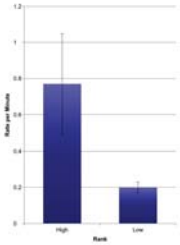


Figure 2b: Differences in solitary levels between high ranking mothers (M= .7702, SD= .5560) and low ranking mothers (M= .1996, SD= .0578), $t(2)= 1.443$, p= .286.

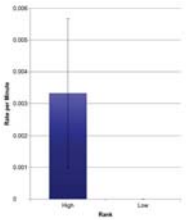


Figure 2c: Differences in agonistic levels between infants of high ranking mothers (M=.0033, SD= .0047) and low ranking mothers (M=.0000, SD= .0000), $t(2)= 1.000$, p= .423.

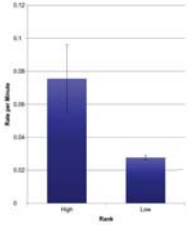


Figure 2d: Differences in affiliative levels between infants of high ranking mothers (M=.0755, SD= .0410) and low ranking mothers (M= .0277, SD= .0024), $t(2)= 1.646$, p= .242.

DISCUSSION

Based on the results and findings in this research study, there was a trend toward significance for infant anxiety. In other words, there may be a relationship between maternal rank and infant anxiety, that being low ranking mothers have more stressed out infants. There were no trends toward significance for the other three behaviors, affiliative, agonistic, and solitary. The effect sizes for all four infant behaviors were high. This concludes that the sample size had to be greater in order for the p values to reach significance.

Infant stress may be related to maternal rank; infants of higher ranking mothers exhibited less stress-related behaviors compared to infants of low ranking mothers. The infants of low ranking mothers were more cautious and demonstrated fear toward their environment or whenever their mother was not in sight. This was determined by examining the infants whenever they were taken away by other individuals, of higher rank or juveniles, from their mother. The infant would exhibit frantic and stressful behaviors, such as, scratching, yawning, and body shaking. Although all of the infants were males, this could also illustrates what researches have supported and suggested about how the temperament of daughters is associated with nervousness and low ranking mothers (Hinde et al. 2015).

Limitations of this study included a small sample size. Only 4 mother-infant pairs were available for observations, which reduced power and our ability to detect differences. All subjects were male, which may have influenced outcomes such as their temperament, as suggested by the literature. All infants were born during the 4 week research study, making them relatively young. During those weeks, infants spent most of their time attached to their mother. This limited the amount of data we could collect on variables that required infants to be detached, such as solitary, agonistic and affiliative behavior.

Future studies should aim for a larger sample size, longer observation time to explore a variety of infant behaviors as they progress in age, and female infants. Exploring new demographics such as these will allow for more in depth exploration into the potential influence of maternal characteristics on infant outcomes.

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