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Ageing effect on grooming activity in langur male bands (*Semnopithecus entellus*) in and around Jodhpur (India)

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Abstract: The study is based on grooming activity in different age class members of *Semnopithecus entellus entellus* all-male bands (AMB). All males seem to reach a peak in grooming frequency during and immediately following puberty and it is suggested that this peak corresponds to a period of establishing coalition bonds. High grooming rates may also be found in young adults who are actively and assertively challenging higher-ranking individuals. Finally, some old males exhibit paternalistic behavior toward young (generally pre-pubertal) males, which includes grooming, co-feeding and active defense by the older male. These observations are consistent with the hypothesis than grooming is an instrumental behaviour analogous to human gift exchange, which can be "used" by an individual for his ultimate benefit.

Keywords: *Semnopithecus entellus*, Grooming, Ageing, Jodhpur

INTRODUCTION

The Hanuman langur *(Semnopithecus entellus* Dufresne, 1797*)* is the best studied and the most adaptable South Asian Colobine. They live in a wide range of habitats from the Himalayas and peninsular forests to semiarid lands, in villages and towns and on cultivated land (Roonwal and Mohnot, 1977). It is well accepted that grooming among primates has a social as well as utilitarian (parasite removal) function (Sparks, 1967; Hutchins and Barash, 1976). However, it is very difficult to determine whether grooming behaviour affects social bonds – i.e., can be "used" as an instrument of social change or merely reflects existing relationships (Oki and Maeda, 1973). Among the thoroughly studied behaviours of baboons and macaques, most grooming occurs within kin groups and during consortships (Sade, 1972; Oki and Maeda, 1973), both relationships that exist independently of the grooming itself. The role of grooming in the formation of dynamic relationships in these species has previously been demonstrated (Packer, 1977; Smuts, 1981; Vijay, 2009). A major reason for this is that grooming networks among females are so stable that change is rarely observed, and grooming among males of these species is so seldom seen that most workers are forced to drop intermale grooming from any sort of quantitative analysis (Drickamer, 1976).

Langur all-male bands are ideal for the study of dynamic social processes. Although kinship may affect the structure of subgroups within the band, it is clear that an all-male group cannot perpetuate itself as a stable, closed social group comparable to matrilineal bisexual troops. There is thus a context for the formation of long term social relationships among intensely competing individual, within a group that is not structured around stable, multiple-generation lineage groups (Sharma *et al.,* 2011).

This paper presents data on the distribution of grooming bouts observed in a male band of Hanuman langurs, *Semnopithecus entellus*, and discuss the relationship between grooming, coalition formation and age-specific reproductive tactics.

MATERIALS AND METHODS

Study area: Jodhpur is located in Rajasthan at the eastern fringe of the Thar Desert. The town is founded in 1498 AD and erected on a hilly sandstone plateau of approximately 150 km^2 surrounded by flat semi-desert lands. And this plateau is inhabited by a geographically isolated population of about 2000 langurs which has been studied by various Indian and foreign researchers for more than three decades (Rajpurohit *et al.,* 2010).

The climate here is dry with maximum temperatures 48 ℃ in May/June and minimum around 0 ℃ in December/January. Jodhpur receives 90% of its scanty rainfall (average 380 mm) during the monsoon in July-September. The natural open scrub vegetation is dominated by xerophytic plants including *Prosopis juliflora*, *Acacia senegal*, *Prosopis cineraria* and *Euphorbia caducifolia*. There are numerous irrigated parks and fields.

Study animal: The Hanuman langur (*Semnopithecus entellus*) is the best-studied and most adaptable South

Asian Colobine. The species has a highly variable social organization. Two basic types of social groups are bisexual troops and all-male bands. The bisexual troops are matrilineal groups of adult females and offsprings with either one adult male (unimale bisexual troops) or more than one adult male (multimale troops). The percentage of unimale troops versus multimale troops and the corresponding number of extra troop band males varies from site to site. The unimale bisexual troops are predominant around Jodhpur where besides temporary multimale situation during male band invasion, in 99% the reproductive social units are one-male bisexual troops or harems. The langurs are easy to observe since they are not shy and spend most of the day time on the ground (Mohnot, 1974; Roonwal and Mohnot, 1977).

This study site supports an isolated population of some 2000 langurs, comprised of 35-36 bisexual troops and 15-16 all-male bands. The bisexual troops are made up of females of all ages with accompanying infants of both sexes, and generally a single adult male. The juvenile males are driven out of the bisexual troops who join the all-male bands which thus comprised of males of all ages except infants. The bisexual troops occupy home range varying in size 0.5 to 1.5 km², while the all-male bands wander over much more extensive home ranges of 10.5 to 15 km² (Rajpurohit, 1987; Rajpurohit and Sommer, 1993).

Procedure: The paper is based primarily on analysis of the distribution of 700 grooming episodes among members of two all male bands (AMB's) of *Semnopithecus entellus*. These observations were made during a one year 1000 hour study of langur AMB's at two sites in Jodhpur, India Daijar and Barli. Only *ad libtium* observations have been used in the present analysis, and a more detailed account of grooming in langur AMB's will be presented in forthcoming papers. The present study focused on AMBs found in Daijar which is located Northern side of Jodhpur. This AMB was commensal with humans, obtaining most of its food by begging or stealing. The AMB Daijar changed slightly in composition during this study, and only those males who were members throughout the observation period are included in this analysis. There were 15 adults and six juveniles and adolescents in this band.

Relative ages of the males were estimated, using the following categories and criteria: (1) GI ("glans in"): Small testes, not descended, glans of penis not visible. (2) GI/O: Testes descending, glans sometimes visible. (3) GO: Testes down, glans visible, perineal pads undeveloped; smaller then adult. (4) YA: Not yet full size; face smooth, teeth unworn/clean, perineal pads small. (5) A: Full size; Perineal pads pink, often puffy. (6) Old: Teeth conspicuously worn, accumulated scars and injuries, wrinkled facial skin. Categories 1-3 are based on clear maturational stages, and it was generally easy to classify

young males. However, estimation of relative ages among adults is often difficult and results were treated with caution. Most of this discussion is based on Three one old male "OM"; one Adult male, "AM"; and one Young Adult male, "YA". OM's teeth were clearly much more worn than AM's, and YA was still several kilograms below adult weight, so the estimates for this group are likely to be correct.

When a pair of males grooming was first seen, their identities were recorded. Direction of grooming was recorded only when the pair was first seen. Subsequent grooming episodes during the same interaction between two individuals are not included here. The males are arranged in age order, with the oldest at the top.

RESULTS

During the study period we took eight identified male of different age category. There are three things to look at the time of observation First, the oldest male, "OM", was observed grooming other males 34 times. This is a moderately high count, and he differs markedly in this from "AM", the alpha male, and somewhat less dramatically so from "YA", the "YA" beta male. Old male had an especially close relationship with the GI-GO class. It is tempting for an evolutionary biologist to speculate that this old male is their father, and in fact "OM" was probably resident. For now, the point is that some old males have relatively close grooming relationship with young ones, and this may represent a form of investment in these young band members. The same two old males often allowed young GI males to feed near them, and actively defended GIs from other males during intergroup fights; "OM" usually slept huddled with another male during the cold season.

The next point of interest is "YA". He was just reaching adulthood during this study, and was very actively working his way up the dominance hierarchy. When we began observations on the All Male Band (AMB) Daijar, he was subordinate to "OM" but very soon rose up over him in rank. The interesting thing to note is that while YA's total grooming score (23) is not very high, his grooming is very narrowly distributed.

This pattern was also seen in another band, in which a young adult (YA) male dramatically targeted an older, dominant individual and almost simultaneously began grooming him often as well as assertively displacing him. Grooming may be a way of facilitating a rank change, perhaps a way of keeping the targeted individual's goodwill and potential help in intergroup encounters while displacing him from his higher rank. Both of the males seen to use this tactic were young adults, distinctly smaller than the males they targeted.

The final point on grooming is related. The only two GI/O males in the AMB Daijar throughout the study were

Table 1. Ratio of grooming given/grooming received. Males are listed in dominance rank order, alpha at the top. (AMB-Daijar) during 2009-2010.

Identified male	Category as mention in procedure	No. of grooming given	No. of grooming recieved	Ratio between No. of grooming given/recieved
AM	A	9	34	= 0.26
YA	YA	23	27	= 0.85
OM	Old	33	58	= 0.57
M3	GO	31	19	= 1.63*
M2	GI/O	36	27	= 1.3
M2A	GI/O	74	10	= 7.40*
MB	GI	12	36	= 0.33*
MA	GI	2	15	= 0.133

*Crippled (missing part of a forelimb).

"M2" and "M2A" (both are the identified males of the AMB). They have the two highest grooming scores; M2A's being more than twice that of M2. Both of these individuals have descended testes, but the glans of the penis is often retracted and it seems reasonable to assume that this is a transition period for them, socially as well as physically. If grooming is a way of establishing affiliative relationships, these two males are putting considerable effort into forming interindividual bonds. Among adults, coalitions do exist and membership in a strong coalition do exist and membership in a strong coalition may be higly important to a male. This peak of grooming during the GI/O stage may represent the establishment of adult coalition bonds. In this scenario, from extremely active but relatively indiscriminate grooming, the GI/O would – at least in a larger band – select a smaller group of males with whom to establish closer ties. For example, "M3", a GO male, has a total grooming score almost as high as M2's. However, while M2's grooming is distributed comparatively evenly across all eight other males.

In the context of grooming as alliance formation it is very interesting to note the ratios of grooming given to grooming received (Table 1). Disregarding the three GI males, this ratio is highest for M2A and for M3. The difference between M2's ratio and M2A's is especially striking; the two are almost the same age.

Both M2A and M3 do not have a part of a forearm, probably as a result of electrical burns on the power lines that supply Jodhpur, which run through the Daijar AMB' range. Clearly, such handicapped individuals are poor choices as a potential partner in an aggressive coalition, and it may not be surprising that the other members of the band tend not to reciprocate their grooming. If such factors are influencing the young males' grooming decisions, MB's low ratio and obvious popularity are puzzling. He also missing an arm, and in fact looks exactly like a smaller version of M2A. Further analysis of social interactions within the AMB Daijar group may clarify his position in the group; for now, MB serves as a caution

against uncritical acceptance of apparent patterns among the older males.

DISCUSSION

Male langurs appear to go through a series of stages in the patterns of grooming they exhibit. The following summary is, for the sake of clarity, typological and should be regarded as heuristically useful but not necessarily descriptively complete or absolute.

The very young male langur rarely grooms with other individuals. As he gets older, he grooms other individuals relatively indiscriminately for several years, before becoming selective at about the age of puberty. This selectivity seems to be based, at least in part, on his judgment of other individuals' physical potential as allies. As the male approaches adulthood, this used of grooming to establish affiliative bonds can become linked to tactics for achieving high rank, and he may use grooming to preserve coalitions while at the same time trying to improve his position within them. The adult, non-socially mobile male receives a good deal of grooming, but grooms others comparatively little. Finally, some old males form close grooming and protective relationships with young; studies of genetic markers would be needed to establish whether or not these are paternal relationships. These stages may well exist in other primate species, where smaller numbers of interactants make their detection difficult and significance unclear. For example, the peak in grooming near puberty has been reported for male chimpanzees and rhesus monkey (Merrick, 1977).

The data available here does not allow one to confidently decide whether grooming is affecting or reflecting social relationships. However, it does demonstrate that grooming is associated with dynamic transitions in a male langur's life (puberty, rise in rank), which lends support to the "active" hypothesis. Reynolds (1981) has discussed the similarities in both form and function between grooming and human gift exchange networks. He argues that grooming is an instrumental behaviour

that can be used to manipulate social relationships, and that "ulterior motives" may lie behind apparently affiliative grooming. This emphasis on seemingly deliberate, goal directed manipulation of social relationships - distinguished from, for example, simple processes of resource-specific competition – is also found in Curtin's description of male langur competition for status in the absence of competitive foci (Curtin, 1981). The present results are, at the least, consistent with such a view of langur intermale competition.

ACKNOWLEDGEMENTS

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