

The pattern of play behaviors in white-headed langurs from 1 to 12 months old in limestone forests, southwest China

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Abstract

Play behavior is a significant trait of immature nonhuman primates (hereafter primates), which may play important roles in sensory, locomotor, socio-cognitive, and developmental processes in primates. It has been suggested that function of play is to practice and improve motor skills related to foraging, avoiding predation, attracting mates, raising offspring, and also is to strength social skills concerning to cementing friendly relationships and defraying aggression among individuals. From September 2009 to August 2010, we investigated play behaviors of 1-12-month-old white-headed langur (*Trachypithecus leucocephalus*) which is a critically endangered primate endemic to China. During this study, we recorded 4,421 play bouts and 1,302 minutes of play time of 7 infants in total. We found that infants had different play behavior patterns at different ages. Specifically, non-social play behaviors appeared at 1 month of age, social play behaviors at 2 months, and all types of social and non-social play behaviors at 3 months. The frequency and duration of non-social play peaked at 5 months and then decreased, while social play appeared at 2 months and gradually increased with age. Non-social play did not differ between the sexes, whereas social play showed sex specificity, with higher frequency and duration of social play in male infants than in female infants. In addition, male and female white-headed langur infants appeared to prefer the individuals of same sex as social playmates. In conclusion, we first reported the pattern of play behavior of a critically endangered langur aged 1 to 12 months though the sample size is small, our results suggest they may have the adaptation of play behaviors in ages and sexes, which may help them adapt to their habitat and social system.

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Table 1. Composition of the white-head langur study group.

No.	Name	Birthday	Sex	Mother	Age range during observation
1	XC (Xiao Chou)	09-05-2009	Male	HT (Hei Tou)	1-12 months old
2	DM (Duan Mian)	09-15-2009	Female	XB (Xiao Bai)	1-12 months old
3	XB (Xiao Bao)	10-10-2009	Female	SH (San Hua)	1-11 months old
4	TQ (Tu Qi)	10-20-2009	Female	JM (Jian Mao)	1-11 months old
5	HM (Hui Mao)	11-10-2009	Female	DY (Du Yan)	1-10 months old
6	DD (Dou Ding)	11-12-2009	Male	HB (Hua Bi)	1-10 months old
7	XY (Xiao Yao)	03-23-2010	Male	JG (Ji Guan)	1-6 months old

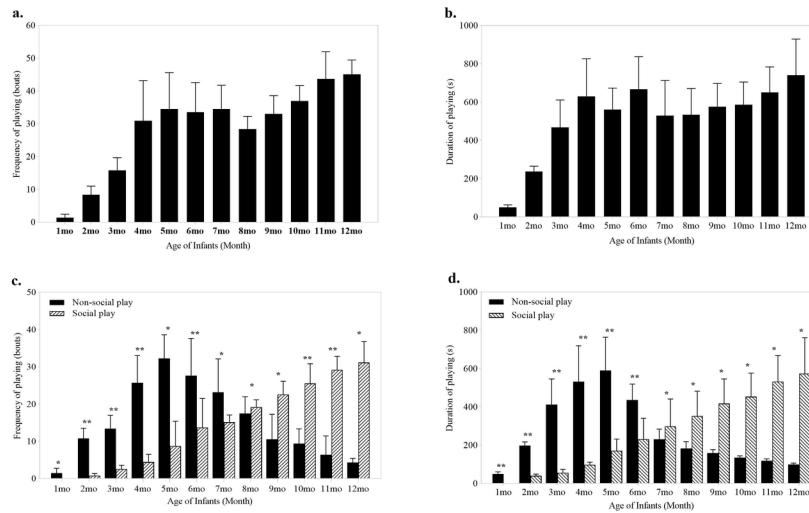


Table 2. Each individual's observation time (and duration proportion of play for each month-old) (minutes).

Age	XC (Xiao Chou)	DM (Duan Mian)	XB (Xiao Bao)	TQ (Tu Qi)	HM (Hui Mao)	DD (Dou Ding)	XY (Xiao Yao)
1 month	30 (7.2%)	10 (16.3%)	40 (10.2%)	10 (16.7%)	70 (30.0%)	30 (10.9%)	20 (9.1%)
2 months	60 (22.0%)	90 (18.5%)	80 (22.4%)	110 (32.7%)	40 (21.3%)	80 (37.0%)	50 (23.5%)
3 months	180 (48.3%)	100 (26.4%)	60 (15.9%)	70 (35.4%)	70 (28.3%)	90 (34.9%)	230 (24.5%)
4 months	80 (52.1%)	120 (35.7%)	70 (29.7%)	40 (33.3%)	50 (44.1%)	60 (44.0%)	20 (40.2%)
5 months	87 (49.4%)	100 (30.5%)	40 (37.9%)	50 (56.3%)	90 (43.1%)	70 (48.9%)	22 (42.2%)
6 months	40 (48.4%)	60 (33.9%)	90 (27.9%)	50 (53.2%)	30 (47.7%)	20 (34.8%)	30 (31.8%)
7 months	90 (31.4%)	60 (46.0%)	50 (25.3%)	40 (30.6%)	80 (36.6%)	90 (42.3%)	-
8 months	30 (35.6%)	20 (9.3%)	50 (18.9%)	210 (25.0%)	30 (21.2%)	20 (28.2%)	-
9 months	70 (29.3%)	80 (21.0%)	20 (24.8%)	30 (22.0%)	10 (22.3%)	50 (31.0%)	-
10 months	20 (38.3%)	30 (25.8%)	40 (19.5%)	10 (37.2%)	10 (57.7%)	30 (40.7%)	-
11 months	30 (40.7%)	30 (19.6%)	20 (77.2%)	10 (40.3%)	-	-	-
12 months	30 (35.2%)	20 (55.6%)	-	-	-	-	-

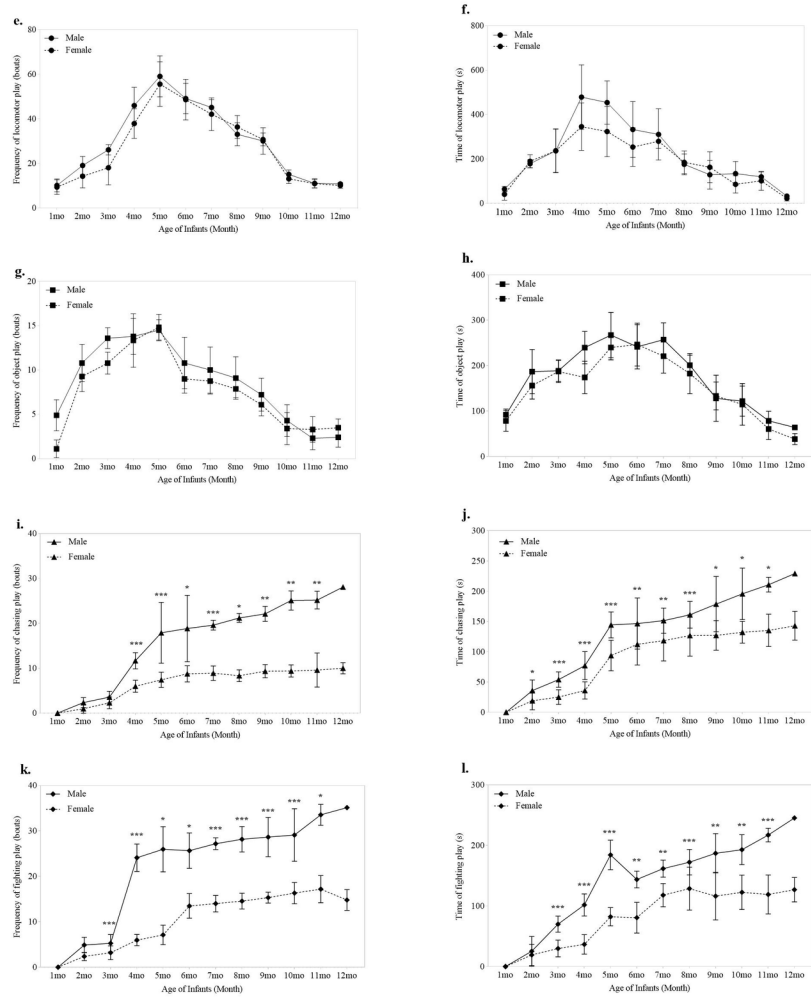


Table 3. Matrices of frequencies of play among infants

I/R	XC ♂	DM ♀	XB ♀	TQ ♀	HM ♀	DD ♂	XY ♂
XC ♂	/	134	68	16	33	82	44
DM ♀	25	/	33	24	28	30	17
XB ♀	25	29	/	30	30	18	10
TQ ♀	9	14	12	/	33	21	25
HM ♀	15	26	27	45	/	25	15
DD ♂	56	16	20	36	24	/	36
XY ♂	11	4	3	7	3	17	/

Table 5. The sex difference in frequency of four types of play behaviours between infant males and infant females during 1-12 month-age.

Age	Frequency of Solitary playing		Frequency of Object playing		Frequency of Chase playing		Frequency of Fight playing	
	F	P	F	P	F	P	F	P
1 month	0.244	0.642	0.004	0.951	/	/	/	/
2 months	0.322	0.595	0.205	0.669	0.368	0.571	1.168	0.329
3 months	0.250	0.683	0.021	0.892	0.334	0.594	32.940	0.002
4 months	1.893	0.227	2.940	0.147	104.700	< 0.001	48.500	< 0.001
5 months	2.195	0.199	0.182	0.692	175.800	< 0.001	15.200	0.011
6 months	0.321	0.596	0.262	0.636	9.004	0.040	8.018	0.037
7 months	0.047	0.840	0.332	0.605	214.700	< 0.001	29.100	0.004
8 months	0.109	0.758	8.080	0.066	22.400	0.041	120.000	0.002
9 months	0.443	0.542	0.801	0.421	54.110	0.005	95.260	< 0.001
10 months	0.729	0.441	1.223	0.331	10.800	0.031	615.3	< 0.001
11 months	0.035	0.869	1.223	0.331	548.500	0.027	118.9	0.018

Table 6. The sex difference in duration of four types of play behaviours between infant males and infant females during 1-12 month-age.

Age	Time of Solitary playing		Time of Object playing		Time of Chase playing		Time of Fight playing	
	F	P	F	P	F	P	F	P
1 month	0.434	0.539	0.331	0.596	/	/	/	/
2 months	0.228	0.653	0.760	0.423	13.420	0.015	4.918	0.077
3 months	0.000	0.999	0.005	0.944	83.350	< 0.001	152.200	< 0.001
4 months	1.402	0.290	4.164	0.097	144.500	< 0.001	118.300	< 0.001
5 months	1.827	0.234	0.606	0.471	70.620	< 0.001	74.280	< 0.001
6 months	1.768	0.241	0.062	0.813	39.520	0.002	22.290	0.005
7 months	1.249	0.326	1.799	0.251	45.790	0.002	27.600	0.006
8 months	0.029	0.873	0.541	0.503	83.110	< 0.001	87.460	< 0.001
9 months	4.060	0.114	0.309	0.608	13.500	0.021	39.050	0.003
10 months	2.009	0.229	0.269	0.632	8.834	0.041	41.670	0.003
11 months	1.082	0.408	0.945	0.434	14.300	0.033	102.200	0.002

Appendix 1

Table 4. Differences in duration and frequency of non-social and social play during 1-12 month-age.

Age	Duration of Non-social playing and social playing (s)		Frequency of Non-social playing and social playing (bouts)	
	chi-squared	p-value	chi-squared	p-value
1 month	8.154	0.005	5.154	0.010
2 months	9.823	0.002	8.283	0.004
3 months	9.800	0.002	9.800	0.002
4 months	9.800	0.002	9.016	0.003
5 months	9.800	0.002	4.444	0.035
6 months	9.425	0.002	7.800	0.007
7 months	6.564	0.010	4.333	0.037
8 months	7.025	0.017	6.564	0.011
9 months	6.923	0.034	4.256	0.026
10 months	6.923	0.034	7.026	0.008
11 months	5.333	0.021	8.083	0.003
12 months	5.412	0.019	6.400	0.021