

Reliability of social dominance in guinea pigs*

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The structure and reliability of social dominance relationships among four male and four female juvenile guinea pigs were assessed by a pairwise testing procedure. Two series of dominance tests, each requiring 7 days, were separated by an 8-day interval. The guinea pigs were housed individually for the duration of the experiment. Dominance hierarchies were determined by ranking the animals according to the total number of opponents they dominated in each test series. The hierarchies emerging from each series of tests were linear. Females were, with one exception, dominant over males. Reliability of the dominance structure was indexed by a high rank-order correlation between the hierarchies measured in each session.

Recent field studies by Rood (1972) indicated that the dominance hierarchies of adult male guinea pigs (*Cavia porcellus*) and related species (commonly termed "cavies") were linear and stable, while adult female guinea pigs did not form well-defined dominance relationships. Juvenile *C. aperea* (closely related to *C. porcellus*) formed unstable hierarchies, with females tending to dominate males. Dominance was assessed in these studies in terms of the frequencies of agonistic and sexual behaviors emitted and received by the cavies in a naturalistic setting. To date, there have been no published reports of laboratory investigation of dominance patterns in guinea pigs.

The present study was performed to assess the dominance structure of a group of male and female juvenile guinea pigs in a competitive pairwise testing procedure, using a water incentive (Clark & Dillon, 1973).

METHOD

Subjects

Ss were four male and four female experimentally naive, pigmented juvenile guinea pigs (*C. porcellus*) obtained from the ABC Caviary and Rabbitry, Pomona, California. Ss were housed individually under a 12-h-light, 12-h-dark schedule, with food available at all times.

Apparatus

All adaptation trials and dominance tests were conducted in a lighted wood cage (75 x 35 x 72 cm high), painted gray, except for a glass window occupying the front of the chamber and a water bottle, with only the spout exposed, affixed to the rear panel. Ss were transferred to the observation chamber from a transport cage attached to the side of the test cage. Two Os were seated at a table about 1.5 m in front of the test cage window, with the room lights off.

Procedure

Ss were water deprived for 19 h prior to being placed in the

test cage, where a 15% (w/v) sucrose solution was available for drinking. The cage was cleaned with a weak vinegar solution after each S was removed. Prior to dominance testing, Ss were placed in the apparatus daily for 5-min sessions, until each S attained the criterion of drinking for 15 sec during the first minute of the session on 2 of 3 consecutive days. Pairwise dominance testing began 2 days after one final nonsocial trial for all Ss. Each S was paired with each other S once for a total of 28 pairings distributed over 7 days, no S being tested more than once daily. Ss had access to water for 4 h after testing. The frequency and duration of drinking by each S was scored on digital recorders during testing, each of the two Os scoring one S. Following each trial, one S was judged to be dominant over the other by the Os. This decision was based on the relative abilities of the Ss to gain and maintain possession of the drinking spout. Two complete series (I and II) of pairwise comparisons were separated by 8 days. Ss did not have visual contact with each other during this interval.

RESULTS AND DISCUSSION

The results of the dominance determinations for both series of dominance tests are presented in Table 1. The hierarchies were defined by ordering the Ss according to total number of "wins." Ties in total "wins" were resolved by determining the "winner" when two tied Ss were paired and, when three Ss were tied, noting which S within the tie had defeated the highest ranked S not in the tie. The conclusion that the dominance hierarchy in each test series was essentially linear is justified since 25 of the 28 pairings in each series were consistent with the prediction of complete linearity (28 of 28 pairings). This result is significantly different from the expected chance outcome of 14 of 28 linear pairings (binomial, $p < .0001$). The reliability of the dominance hierarchies which emerged from the two series of tests was high and significant (Spearman rank-order correlation, $r_s = .88$, $p < .005$).

A comparison between male and female Ss' total "wins" during both dominance tests (56 total pairings) indicated that females defeated significantly more partners of either sex than did males (Mann-Whitney U test, $p = .045$). The females successfully dominated the males in 26 of the 28 total cross-sex pairings. This finding is significantly different from chance (binomial, $p < .0001$). The dominance of females over males is not attributable to weight differences between the sexes, since the males were heavier than the females during both series of dominance tests. The mean body weight of the males in Series I was 356 g, while the females weighed 308 g. During Series II, the males weighed 463 g and females weighed 391 g. Rank-order correlations between body weight and dominance status are negative, low, and not significant for either series of tests.

The mean drinking durations of the Ss, presented in Table 1, are positively correlated with dominance status (Series I: $r_s = .76$, $p < .025$, Series II: $r_s = .86$, $p < .005$). The proportionate contribution (in mean

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Table 1
 Dominance Ranks, Sex, Mean Drinking Durations (in Sec/5 Min), and Mean Percent Drinking Durations
 of Eight Guinea Pigs for Two Series (I and II) of Dominance Tests

		Dominance Rank							
		Highest						Lowest	
		1	2	3	4	5	6	7	8
Series I	Subject	25	23	24	27	26	22	20	21
	Sex	F	M	F	F	F	M	M	M
	Mean Drinking Duration	112	105	125	142	93	79	50	58
	Mean Percent Drinking	64	51	49	60	62	43	34	38
Series II	Subject	24	25	23	26	27	22	21	20
	Sex	F	F	M	F	F	M	M	M
	Mean Drinking Duration	162	108	59	98	89	85	33	23
	Mean Percent Drinking	82	56	41	63	53	52	31	21

percent) of each S to the total drinking durations accumulated during his pairings with each of the seven other Ss within each series is shown in Table 1. These measures are also positively correlated with dominance rank (Series I: $r_s = .81$, $p < .025$; Series II: $r_s = .81$, $p < .025$).

This study demonstrated that juvenile guinea pigs form stable dominance hierarchies in a pairwise testing situation, and that females generally dominate males. This latter observation concurs with Rood's (1972) finding that juvenile *C. aperea* females dominated males. The discrepancy between our results and Rood's observation of a poorly defined social order in juvenile *C. aperea* was probably a result of the different techniques used to assess dominance in the two studies, rather than an indication of an inherent difference between the two species. Rood recorded species-typical agonistic and sexual behaviors in a naturalistic setting, whereas dominance in the present study was defined by a S's ability to maintain possession of the water bottle by pushing another S away or by tenaciously clinging to the spout. We failed to observe agonistic displays in the male guinea pigs in our study, although females occasionally directed head-thrusts at the males when molested.

The cross-sex pairings in the present experiment frequently resulted in perfunctory attempts of three of the males (excluding the most dominant male) to mount the females. These three males spent most of the test session mounting and nuzzling the genital area of the female (termed "naso-anal licking" by Rood) while she

was drinking. Many of these mounting attempts were directed toward the side of the female, and none resulted in ejaculation. The females sometimes abandoned the drinking spout after being mounted, but quickly returned. During these sessions, the "sexual" behavior of the males was not typical of that seen under normal circumstances, since some common components of the mating response, such as the "rumba" (described by Rood), were not observed. Subsequent observations of these Ss in a group setting, conducted immediately following Series II, showed that all the males directed "rumbas" toward the females, and that some successful copulations occurred. In the group situation, the mounting attempts were always preceded by the male following the female, performing "rumbas," and naso-anal licking the female for several minutes, while during the pairwise testing, the mountings were sudden and never clearly predictable on the basis of antecedent motor patterns. The aberrant sexual behavior observed during our pairwise testing may have been a consequence of the unfamiliarity of the Ss with each other and/or the water-deprivation conditions employed.

REFERENCES

- Clark, D. L., & Dillon, J. E. Evaluation of the water incentive method of social dominance measurement in primates. *Folia Primatologica*, 1973, in press.
 Rood, J. P. Ecological and behavioral comparisons of three genera of Argentine cavies. *Animal Behavior Monographs*, 1972, 5, Part I.

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