

## The Effects of *Cannabis sativa* on the Behavior of Adult Female Chacma Baboons (*Papio ursinus*) in Captivity

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**Abstract.** Indices of locomotory and social activity were quantified during 102 h of daily tests with two pairs of baboons under three conditions: baseline, cannabis administration, and postdrug withdrawal. Six percent of whole dried plants of cannabis (33 g) was incorporated into the daily feed. In one pair, social activity increased during cannabis administration, with no clear effect on locomotory behavior. In the second pair locomotory activity decreased, but there was no consistent change in social interaction. Thus individuals responded differently to the drug, and the social environment of each pair appeared to be implicated as a determining factor.

**Key words:** *Papio* — *Cannabis sativa* — Locomotory activity — Social behavior — Individual differences

Controversy concerning the effects of *Cannabis sativa* on behavior has continued for many years. Variations in research methodologies (drug quality, dosage, route of administration, and delay before testing) represent significant confounding factors. Problems are posed by the use of synthetic THC (delta-9-tetrahydrocannabinol)—said to be the principal active component of cannabis—since the cannabis plant contains a variety of psychoactive and interpotentiating substances (Carlini et al., 1974). As Paton (1973) comments: “Pharmacological study is incomplete, therefore, if crude material is not used” (p. 26). In human subjects marked interindividual differences during cannabis intoxication appear to be characteristic (Ames, 1958; Anonymous, 1969) despite dosage control; this has largely been attributed to “set and setting” (Borg et al., 1975). There have been few systematic studies of the effects of cannabis on the social behavior of nonprimate laboratory animals and,

in the nonhuman primates, research has generally employed operant conditioning techniques (review by Miller and Drew, 1974). Most of these studies have used *intravenous* administration and *large doses* of *THC*, all atypical in human use (Ferraro et al., 1972). There has been surprisingly little investigation of the effects of cannabis on general social interaction in nonhuman primates apart from one long-term study of group-living macaques (Sassenrath and Chapman, 1975). In the present study, the effects of the short-term, oral administration of *Cannabis sativa* on the locomotory and social behavior of two pairs of captive female chacma baboons (*Papio ursinus*) were investigated.

### METHODS

Two consistent pairs of healthy, drug-naïve, adult female chacma baboons weighing 16.0–22.4 kg were observed in an outdoor enclosure at the Primate Colony, Karl Bremer Hospital for a total of 102 h during daily 45-min tests seven afternoons per week between 2 and 4 p.m. The animals were housed singly at all other times. There were three consecutive experimental phases: baseline (14 days), cannabis administration (14 days) and postdrug withdrawal (10 days). During the drug phase, 6% of entire dried plants of cannabis (except roots) was incorporated into the animals' usual feed of cube pellets. The homogeneous mixture of cannabis and food ingredients was solidified by a steam process into the usual cube pellet form, which was readily accepted by the animals on the first day of administration. Each baboon received 550 g of feed daily so that during the drug phase of the study each animal received 33 g of cannabis per day. The dosage was determined by Ames in collaboration with Dr. F. Bowey on the basis of an ongoing long-term investigation of the neurological effects of cannabis in the baboon. The animals were fed 1<sup>1</sup>/<sub>4</sub> to 1<sup>1</sup>/<sub>2</sub> h before testing since the effects of cannabis, taken orally by humans, are manifested after approximately 30 min and may last for several hours (Ames, unpublished observations). The onset of the detectable behavioral effects of THC reportedly occur 1 h following oral administration, with maximum effects at 2–3 h in *Macacca mulatta* and *Macacca fascicularis* (Sassenrath and Chapman, 1975). The baboons received no other food except oranges distributed by the experimenter at the end of each testing session.

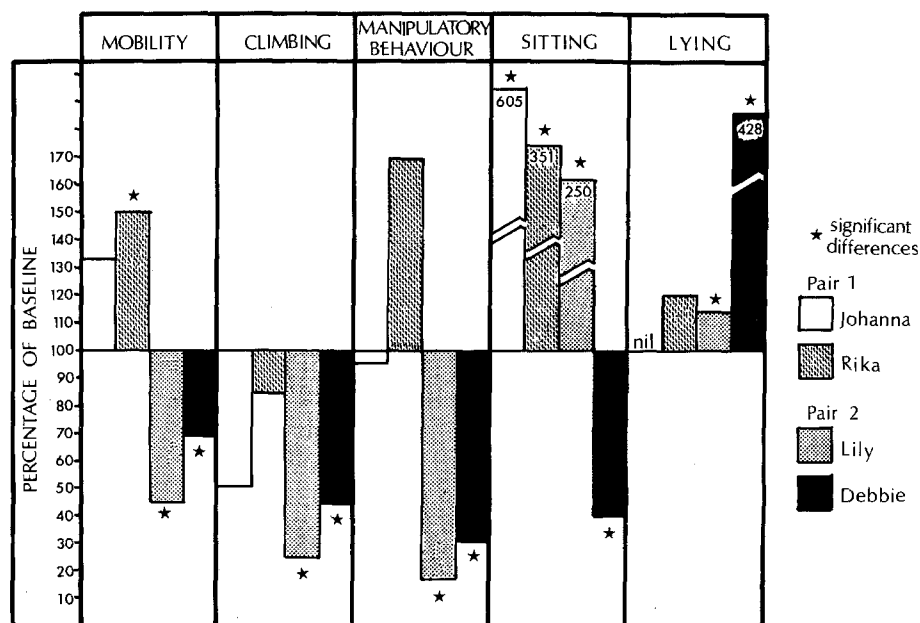


Fig.1. The effects of the administration of cannabis upon indices of locomotory activity in individual baboons. Values represent the percentage change from baseline levels (100%) during the drug condition. There was a trend toward decreased locomotory activity in the second pair (Lily and Debbie)

Five indices of locomotory activity (mobility—measuring relative distances covered by each baboon, climbing, manipulatory behavior, sitting, and lying) and seven categories of social interaction (presentation, mounting, contact, grooming initiation, mutual grooming, play, and aggression) were used to quantify the activity of each baboon by a single observer throughout in terms of frequency or duration. The frequency, order, and duration of testing of each pair of animals was kept constant.

A multivariate analysis of variance (Cooley and Lohnes, 1971) of all behavioral indices was conducted for each baboon. Significant differences in behavioral frequencies according to conditions for each animal were detected by means of the Tukey (Studentized Range) statistic (Kirk, 1968).

## RESULTS

The effects of cannabis administration on the indices of locomotory activity are illustrated in Figure 1 as the percentage change from baseline. There was a marked decrease in the levels of locomotory activity of individual baboons, and this effect was most conspicuous in the second pair of animals (Lily and Debbie). There were highly significant and consistent changes in four of the five indices of locomotory activity in both animals: during the drug phase there were decreases in mobility ( $P < 0.025$ ), climbing ( $P < 0.05$ ), and manipulatory behavior ( $P < 0.005$ ), whereas there was a significant increase in lying ( $P < 0.05$ ). In the sitting behavior category, however, Lily sat significantly more ( $P < 0.005$ ) while Debbie sat significantly less often ( $P < 0.005$ ). Since sitting was measured only in terms of frequency, an

analysis of the duration of sitting episodes may conceivably have eliminated this single incongruent finding. In the first pair (Johanna and Rika) there was no consistent change in locomotory activity: Rika showed a significant increase in mobility ( $P < 0.025$ ) but both animals showed a significant increase in sitting behavior ( $P < 0.005$ ). Thus the decrease in locomotory activity was characteristic only of one pair of animals, and this finding suggested that the influence of individual differences and/or their effect upon the social context of the pair represented an important factor in determining the behavioral responses of the animals to cannabis administration.

The effects of the administration of cannabis upon indices of social activity are illustrated in Figure 2 as the percentage change from baseline. In contrast to the effects upon locomotory activity, there was a marked increase in the indices of social activity for the first pair (Johanna and Rika). Although no marked and consistent effects on locomotory activity were discernible in this pair (Fig.1), both individuals showed significant increases in presentation ( $P < 0.005$ ), contact ( $P < 0.05$ ), and play ( $P < 0.025$ ). Moreover, Johanna mounted significantly more frequently ( $P < 0.05$ ), while Rika attempted significantly more grooming initiations ( $P < 0.05$ ). There were no consistent changes in the social activity of the second pair: significant changes were observed in only one animal (Lily), who showed a decrease in contact ( $P < 0.005$ ) and an increase in grooming initiation ( $P < 0.005$ ).

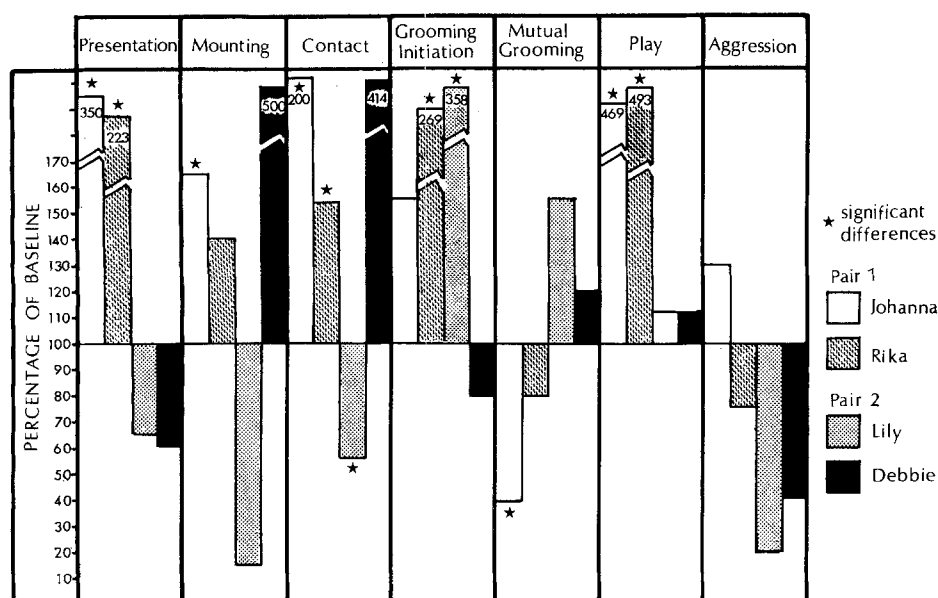


Fig. 2. The effects of the administration of cannabis upon indices of social activity in individual baboons. Values represent the percentage change from baseline levels (100%) during the drug condition. There was a trend toward increased social activity in the first pair (Johanna and Rika)

Cannabis administration did not significantly affect aggressive interactions in either pair, although qualitative observations indicated that the baboons became more docile and less volatile in temperament. Moreover, although the extensive repertoire of vocalizations was not subjected to quantitative scrutiny, a dramatic decrease in vocal exchanges was apparent during the drug phase. The withdrawal phase of the experimental design permitted us to attribute the above effects to cannabis administration.

## DISCUSSION

Two pair-specific trends were apparent during cannabis administration: in one pair there appeared to be a trend toward increased social interaction with no clearly discernible effect upon locomotory activity, while in the second pair social behavior remained largely uninfluenced, although there was a marked decrease in locomotory activity. There appeared, therefore, to be both stimulatory and sedation-like effects upon behavior during the drug phase, suggesting that individual differences influenced responses to the drug. The tendency for the behavior of pairs of animals to vary together in response to the drug further suggested that the social environment was of significance in these highly social and complex primates—a variable that has long been stressed as a factor determining the nature of human responses to cannabis consumption.

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