

MOTHER INFANT RELATIONSHIP IN FREE RANGING RHESUS MONKEY (*MACACA MULATTA*)

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Studies were carried out on the free-ranging rhesus monkeys (*Macaca mulatta*) in their natural habitat in Dunga Gali forests, Murree Hills, Pakistan. Kong group comprising 25 individuals was selected for the studies on mother-infant relationships.

The studies indicated that 3 month old infants behaved alike with respect to play and aggressive behaviour and that social rank hardly influenced infant behaviour. An overall analysis of the social-interaction based on two multivariate statistical techniques, namely, ordination and cluster-analysis, indicated that the development of social activities of rhesus infants are facilitated by the mother.

INTRODUCTION

Much of the early environment of a primate is provided by its mother. An analysis of the interaction between the mother and the infant is thus fundamental to a study of the development of primate behaviour [9]. Behavioural studies of infant monkeys have provided a large number of behaviour repertoires and the nature of interaction with the mother [6, 14].

Maternal care, infant development, and socialization have more thoroughly studied in the rhesus monkey (*Macaca mulatta*) than in any other primate save man [12]. A number of studies under carefully controlled observational conditions have yielded important information on physical and social development of captive subjects [17, 7, 10]. Some workers [21, 15] have emphasized differences in the quality of maternal care and their effect on the development of the infant. Descriptive data on mother-infant interaction under free ranging conditions in Cayo-Santiago have been published [11]. Interaction between infants and finely-divided categories of companions in a free-ranging lineage based on groups of rhesus monkeys at Cayo-Santiago has also been reported [3, 4].

Present studies were carried out on the behavioural analysis of free-ranging infant monkeys (*Macaca mulatta*) with special reference to mother-infant interaction at Dunga Gali Forest (North Western Frontier Province). The studies

were also extended to diurnal changes in infant behaviour and to similarities in behaviour as related to age, sex and rank.

MATERIALS AND METHODS

Study Areas. Dunga Gali is located on a saddle in Murree hills of North-Western Pakistan at ($74^{\circ} - 23^{\circ}\text{E}$ and $34^{\circ} - 4\text{N}$) at an approximate elevation of 8,200 ft. These hills constitute a watershed running north-south from which water drains east into Jhelum River and west into the Indus.

The study site is one of the many valleys draining toward the east. The boundaries to the area are as follows:

- (1) To the west, from the village of Kundla to Lazar about 3-4 miles;
- (2) To the north is the Mukshpuri peak with a height of 9,200 ft. (its slopes run in a linear distance of 4 miles down to a valley floor, which is 4,700 ft. high);
- (3) to the South is a ridge running from Khanpur to Dunga Gali for about 3 miles; and
- (4) to the east and easternmost extremity of the Khanspur ridge and the village of Jalsi. (The whole area is approximately 20 square miles).

Five groups of monkeys were located in Dunga Gali. The Kong group was selected for the study of mother-infant relationship, as the composition of the group was known (Table 1).

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Table 1. Detailed information on Kong-group

Identity No.	Name	Ear Notches	Rank	Age	Sex
<i>Adults</i>					
034	Kong	f ↓	Alpha male	Adult	Male
037	Wayn	f ↓	High ranking	"	"
044	Eric	f ↓	Peripheral	Pre-adult 4/5	"
040	Ralph	[↓	Peripheral	"	"
-	Tony	[]	Peripheral	Juvenile 3 Yrs	"
046	Cliff	f ↓	Peripheral	" "	"
047	Joshua	[]	Peripheral	Juvenile 2 Yrs	"
041	Ross	f ↓	Peripheral	" "	"
033	Luna	f ↓	Highest ranking	Adult	Female
039	Sparky	[]	2nd in rank	Infant	"
038	Scottie	f ↓	3rd in rank	Luna's daughter preadult 3 Yrs	"
042	Honey	f ↓	4th in rank	Preadult	"
035	Clara	f ↓	5th in rank	"	"
030	Maude	f ↓	Low ranking	Adult	"
032	April	[↓	Low ranking	Adult	"
038	Whisker	f ↓	Low ranking	Adult	"
031	Sophie	f ↓	Low ranking	Adult	Female
043	Anne	f ↓	"	April's daughter 4 Yrs	"
-	Gus	[]	"	Maude's daughter 4 Yrs	"
045	Barbra	f ↓	"	Sophie's daughter 4 Yrs	"

Contd....

Identity No.	Name	Ear Notches	Rank	Age	Sex
	<u>Infants</u>				
	Fuzz	[]		Whisker's 3 Months Son	Male
	Bea	[]		Honey's yearling daughter	
	Minni	[]		Maude's yearling daughter	
	Fool	[]		April's yearling son	Male
	Goach	[]		Sophie's yearling Son	
	Adult Male	-	More than 5 years		
	Adult Female	-	More than 3 years old		

Field Studies. Studies were initiated from 2 March 1979 and continued for over a period of year. There were six infants in the Kong group. The infant behaviour was arbitrarily divided into three components:

- (1) Social behaviour
- (2) Play behaviour
- (3) Aggressive behaviour

A sampling day was divided into 14 time-blocks of one hr. each, starting at 5 a.m. The activity of each infant was studied every minute in an observation period of 10 min, selected randomly in a time block, and recorded on a data-sheet.

The animals were habituated to traps by providing them with corn and potatoes. After trapping they were brought to the laboratory. The monkeys were tattooed and their age and sex were determined.

NUMERICAL METHODS

The analysis of the data on the behavioural activities of the 6 infants was carried out by two different numerical techniques, namely, ordination and cluster analysis.

Ordination was employed to study the relationship of the different time-blocks with respect to the activity pattern of a particular infant; in other words, this technique was

considered to show the appearance of a similar set of activities in different time-blocks. To accomplish the ordination, the technique of Bray and Curtis [25] was employed incorporating the modifications suggested by Beals [1]. In this technique dimensions can be reduced to $n - k$ dimension with insignificant distortion of the internal structure where both n and k are integers with a $n > k$. Usually polar ordination is accomplished to 2 to 3 dimensions. In the present study a two dimensional ordination was found sufficient to give a fruitful clustering of the time blocks on the basis of activity patterns of infants. Cluster analysis was employed to study relationship between all possible pair groups of infants on the basis of behavioural activities. Crovello's coefficient was employed in place of the simple distance coefficient because it eliminates the effect of time-to-time deviation of the activities observed [22].

RESULTS

Some characteristics of the presently studied free-ranging group of rhesus monkeys, Kong-group, are outlined in Table 1.

Phenograms constructed through UPGMA*, using Crovello's coefficients on the basis of social behaviour,

* Unpaired-group method using arithmetic averages (Sneath and Sokal, 1973).

play behaviour, aggressive behaviour and behaviour as a whole are represented in Figs. 1-6.

On the basis of social activities (Fig. 1), it is apparent that Minni and Bea were highly similar in their behavioural activities, of which feeding, grooming and contact with the mother were of particular importance.

Fool and Goach showed resemblance with each other in social behaviour to a lesser extent as did Minni and Bea. Their behavioural resemblance was mainly in sucking the nipples, feeding and being carried by the mother. In all other respects of social behaviour, the Minni-Bea and the Fool-Goach groups showed resemblance of varying degree within the group. However, these two groups of infants were more closely related with each other on the basis of social behaviour than with Fuzz or Sparky. Fuzz and Sparky remained isolated with respect to social activities (Fig. 1).

On the basis of play behaviour (Fig. 2) Fuzz and Sparky were the most closely associated in behavioural patterns. However, their resemblance was particularly

pronounced in hanging and jumping. Besides the Fuzz-Sparky group, Bea and Goach also formed a closely resembling infant group with respect to play behaviour but their resemblance was particularly pronounced in grappling, mounting and running. Fool and Minni showed least resemblance with each other as compared with other two groups of infants. However, they remarkably resembled in auto-play. Beside their resemblance with each other, Fool and Minni were more closely related with the Bea-Goach group, than with Fuzz-Sparky group. Thus, as with social behaviour, Bea, Fool Goach and Minni were also more closely related to each other than to Fuzz and Sparky on the basis of overall play behaviour.

Aggressive behaviour (Fig. 3) appeared to be less informative as compared to social and play behaviour. However, even on this basis Fuzz and Sparky formed a separate group with the exception that Fuzz behaved more particularly in letting out pronounced shrieks.

Overall comparison of the infant behaviour (Fig. 4) of Minni and Bea indicated a closer resemblance of these

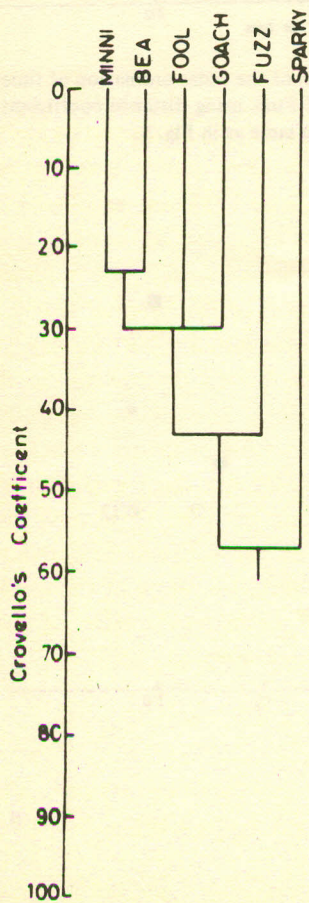


Fig. 1. Average-linkage cluster-analysis of the 6 infants on the basis of social activities using Crovello's coefficient.

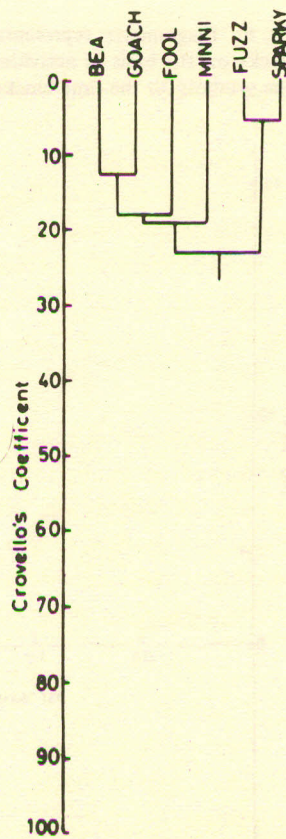


Fig. 2. Average-linkage cluster-analysis of the 6 infants on the basis of play-activities using Crovello's coefficient.

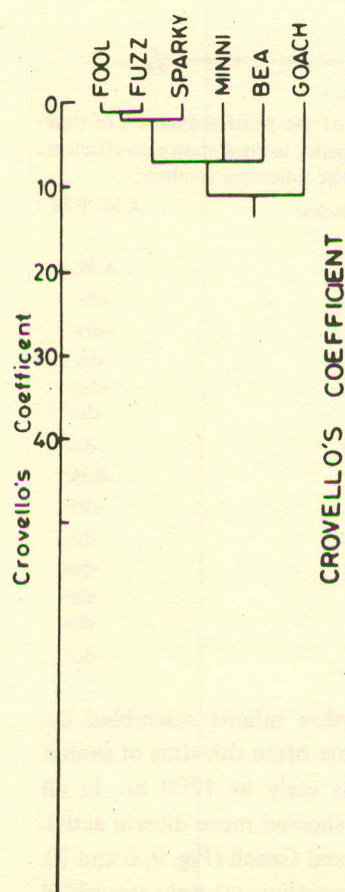


Fig. 3. Average-linkage cluster-analysis of the 6 infants on the basis of aggressive activities using Crovello's coefficient.

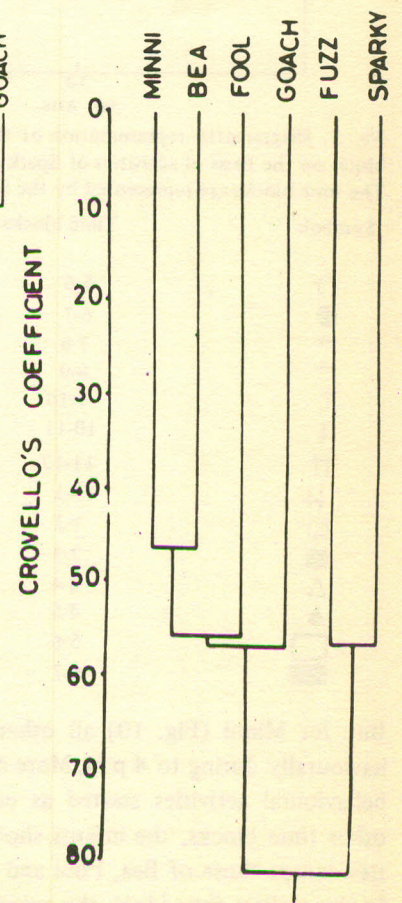


Fig. 4. Average-linkage cluster-analysis of the 6 infants on the basis of all activities using Crovello's coefficient.

infants. Fuzz and Sparky formed a group of less closely related infants. Fool and Goach formed a group of least closely related infants, as compared to the other two groups. However, the Minni-Bea group was more closely related to the Fool-Goach group than with Fuzz-Sparky group.

Results of the polar ordination of 14 time-blocks on the basis of overall activities exhibited by each infant are diagrammatically plotted along the first two-axes in Fig. 5-10.

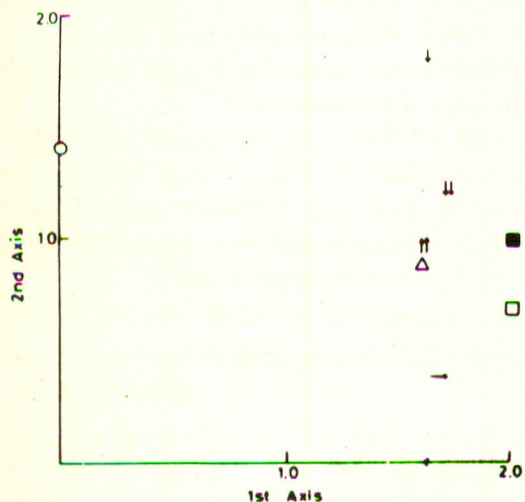


Fig. 5. Diagrammatic representation of the polar-ordination of time-block on the basis of activities of Sparky using distance co-efficient. The time blocks are represented by the following symbols:

Symbols	Time blocks	A.M./P.M.
○	5-6	A.M.
●	6-7	-do-
→	7-8	-do-
↘	8-9	-do-
↑	9-10	-do-
↓	10-11	-do-
↕	11-12	-do-
↕	12-1	P.M.
□	1-2	-do-
■	2-3	-do-
△	3-4	-do-
▲	4-5	-do-
◻	5-6	-do-
◼	6-7	-do-

But for Minni (Fig. 10) all other infants resembled behaviourally during to 4 p.m. More often this time of similar behavioural activities started as early as 1200 hr. In all other time blocks, the infants showed more diverse activities except those of Bea, Fool and Goach (Fig. 9, 6 and 7). In the earliest time block the activities not only resembled within those time blocks but also closely resembled with those occurring in the noon and afternoon. It shows the occurrence of two peaks of coincident activities in Bea,

Goach and Fool. On the other hand Sparky and Fuzz hardly showed the occurrence of coincident activities in the morning and noon.

Although Fuzz and Sparky (Fig. 5, 6) behaved almost

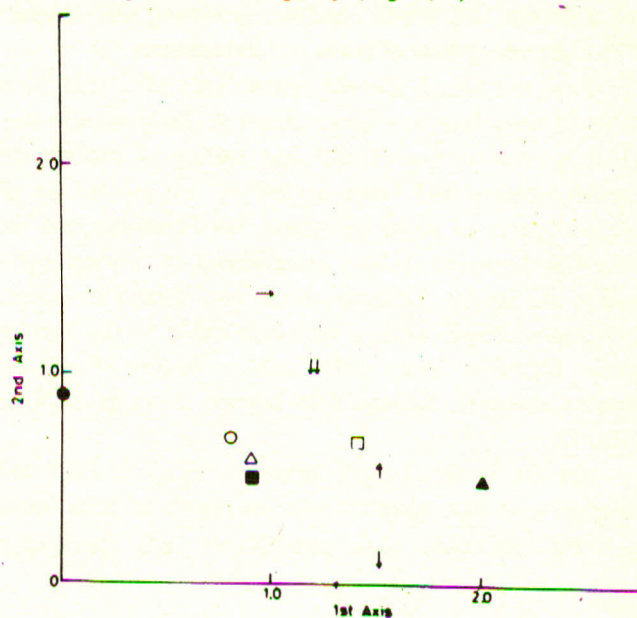


Fig. 6. Diagrammatic representation of the polar-ordination of time-blocks on the basis of activities of Fuzz using distance coefficient. The symbols for the time-blocks are same as in Fig. 5.

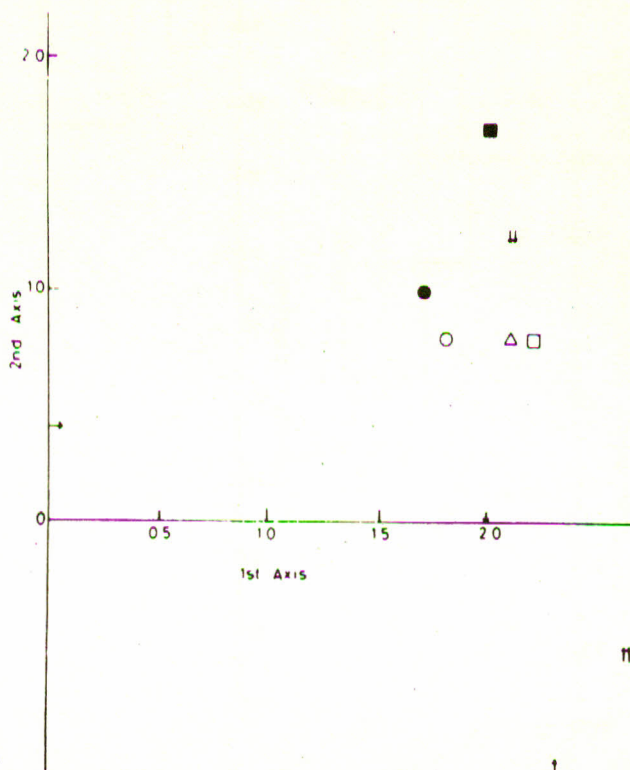


Fig. 7. Diagrammatic representation of the polar-ordination of time-blocks on the basis of activities of Goach using distance coefficient. The symbols for the time-blocks are same as in Fig. 5.

invariably in the noon and afternoon the set of activities which remained almost invariable during this period differed in these two infants. The set of activities which differentiated Sparky from Fuzz in the noon and afternoon were mainly grooming and hanging. On the other hand, in being carried by the mother and in auto-play and running, Fuzz

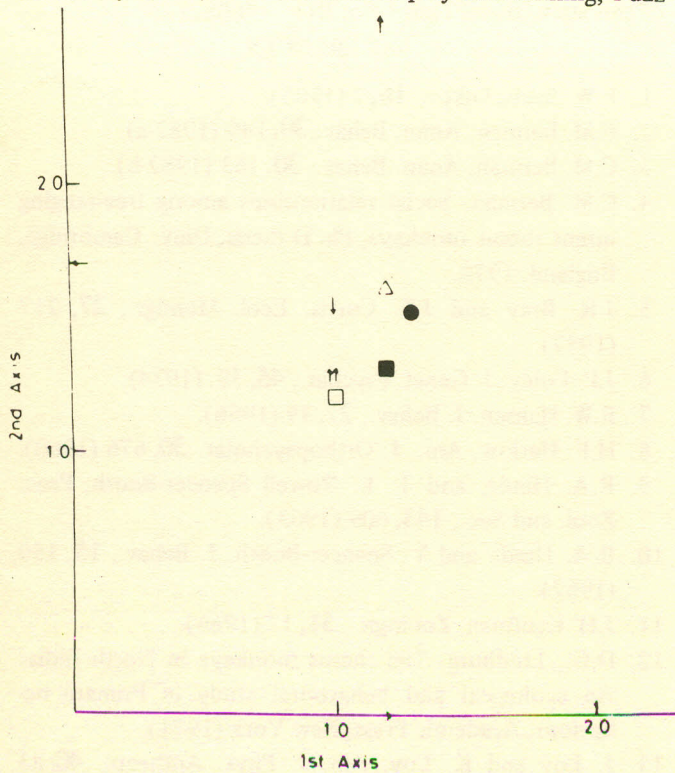


Fig. 8. Diagrammatic representation of the polar-ordination of time-blocks on the basis of activities of Fool using distance coefficient. The symbols for the time-blocks are same as in Fig. 5.

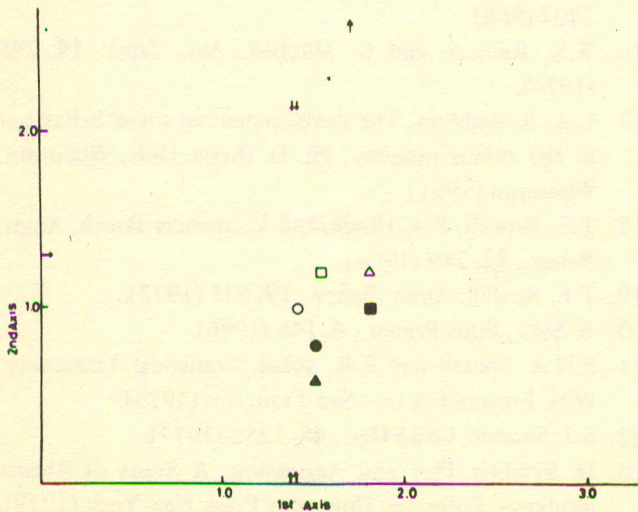


Fig. 9. Diagrammatic representation of the polar-ordination of time-blocks on the basis of activities of Bea using distance coefficient. The symbols for the time-blocks are same as in Fig. 5.

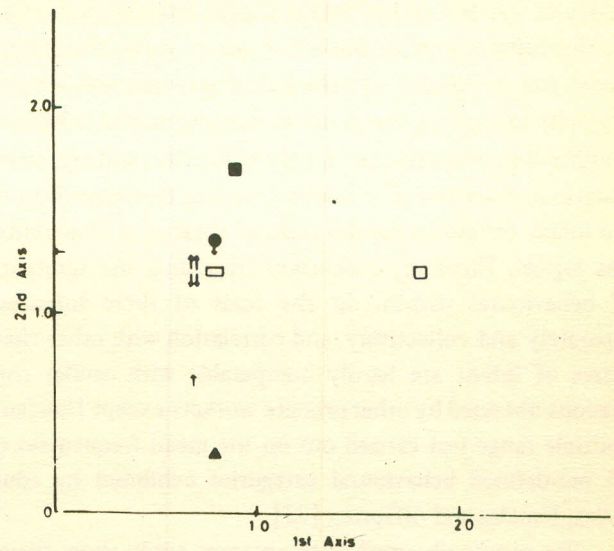


Fig. 10. Diagrammatic representation of the polar-ordination of time-blocks on the basis of activities of Minni using distance-coefficient. The symbol for the time-blocks are the same as in Fig. 5.

behaved differently from Sparky during this period. However, feeding and jumping remained equally frequent in these two infants. As already pointed out, the activities of Fool, Bea and Goach not only remained invariable early in the morning but also the same set of activities were repeated in the noon and afternoon. Among these activities feeding defined these two time periods. However, hanging remained a peculiar activity of Fool and following the mother and running remained peculiar to Goach, while none of the activities were peculiar to Bea during these time periods.

DISCUSSION

Although intensive qualitative and quantitative studies on the behavioural repertoires of infant rhesus monkeys have been conducted by several primate workers in last two decades [8, 9, 19, 12, 20, 7, 16, 13, 24] which led to sexual as well as rank comparison in captive and free-ranging rhesus infants, yet only a little work has been done on intra-group relationship of infant behaviour [2, 3, 4]. Recent studies indicate that infants in a heterogenous social group spend little time playing with their mother and even less time with adult males. However, when given the same opportunity for the mother and the adult male to play with the infant in the absence of peers, intense and frequent play develop in the adult male vs infant dyads [16]. Infants of free-ranging rhesus monkeys were reported to have more positive social interaction with close kin than with distant kin or with unrelated companions, and thus functioned as members of lineage from their earliest life [3, 4].

These trends point out to a great flexibility in the behavioural system of the infant rhesus monkey depending on the composition of the social group. As in the present study, the overall list of behavioural activities was arbitrarily split into three components, namely, social behaviour (mother-infant interaction), play behaviour, and aggressive behaviour, selection of a method leading to comparison of the infant behaviour on the basis of these sets of activities was logical. However, conclusions regarding the similarity of behavioural pattern on the basis of these activities, separately and collectively, and correlation with other characters of infant are hardly comparable with similar conclusions obtained by other primate workers except Duncan's multiple range test carried out on the mean frequencies of 15 pre-defined behavioural categories exhibited by adult males, females and offspring [23].

The results obtained in the present study show strong correlation of infant behaviour with age. Out of six infants studied, Sparky and Fuzz were in the same age group, i.e. 3 months (at the start of the study). Although these two youngs behaved very much like each other with respect to play and aggressive activities, yet they were, however, dissimilar in social activities. This difference might be attributed to their difference of rank. All other infants were yearlings and broadly behaved like each other on the basis of overall activities. However, Minni and Bea did more closely so. This may probably be due to the sexual difference of the two groups of infants thus formed. If this hypothesis is proved then it would not be uncautious to say that sexual differences do have an impact on infant behaviour irrespective of rank. Also, extreme resemblance of Bea and Minni on the basis of social activities is a further clue to the social rank which hardly intervenes in the infant behaviour.

The overall analysis of infant behaviour clearly shows that all categories of social activities, hence the mother-infant interaction, give more information than do play and aggressive behaviour, for very similar results are obtained on the basis of social activities and overall activities. These findings automatically lead to the conclusion that aspects of behaviour which fall in the list of social activities, in the list of presently studied activities, are more stereotyped than play and aggressive activities. It is suggested that any future study on these lines should be based on mother-infant interaction relationship. Lastly, the mother-infant relationship presently studied, indicates that the maternal rank has no visible impact on the social activities of the infants although maternal care such as carrying, restraint, keeping the infant within visual range, and allowing the infant to suck at the nipple off and on, indicate that the developmental and social activities of the infant are facilitated by the

mother.

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