

Effects of Infant Loss on the Interbirth Interval of Japanese Monkeys

TOSHIO TANAKA, KISABURO TOKUDA,
and SHIGETAKA KOTERA

Japan Monkey Centre

ABSTRACT. This report analyzes the intervals between births which might be affected by interrupted lactation due to the loss of young in a group of semi-wild Japanese monkeys. Of a total of 168 births whose days of interbirth interval are countable, births with an approximate one-year's interval numbered 53 cases (31.5%) and those with a roughly two-year's interval 107 cases (63.7%). Among the 168 cases of birth, those resulting in "loss of infant" within 185 days, a figure obtained by subtracting the 180 days of the gestation period from 365 days, the mean interbirth interval, numbered 40, in which 38 females (95%) subsequently gave birth in the following year. On the other hand, only 11 (8.6%) out of the remaining 128 females who did not lose their infants gave subsequent birth in the following year. These data indicate that parturition in successive years is much more prevalent among females who suffer "loss of infant" than among those who do not. From the results, it is suggested that separation of infants from their mothers increases the reproductive ability of the mothers and this separation should be made at the latest, before or during the following mating season, for the purpose of increasing reproduction.

INTRODUCTION

It is known that lactation affects a number of other reproductive phenomena in mammals, particularly in terms of the implantation of the blastocyst (SADLEIR, 1969), follicular growth, and ovulation (YOUNG, 1961). In cynomolgus monkeys (*Macaca irus*), females not lactating due to stillbirth or postnatal mortality of infants were found to have the first postpartum menstruation earlier than lactating females (FUJIWARA, HONJO, & IMAIZUMI, 1969). It was also reported that in free-ranging rhesus and Japanese monkeys such a difference in the resumption of the menstrual cycle between lactating and non-lactating females further influences their birth interval (KOFORD, 1965; KAWAI, 1969). Nevertheless, as far as the cotton-top pinché (*Oedipomidas oedipus*) is concerned, no difference was found in the birth interval between lactating and non-lactating females (HAMPTON & HAMPTON, 1965). Therefore, the birth interval in primates, depending on species, seems not to be always affected by lactation.

MATERIALS AND METHODS

The present report concerns an analysis of the effects of interrupted lactation due to loss of young on the interbirth interval. The data of births were collected from a

group of free-ranging Japanese monkeys (*Macaca fuscata yakui*) at Ohirayama, Inuyama, Aichi. Animals belonging to the Ohirayama group were introduced from Yaku Island, located at the southern tip of Japan, to the mountain adjoining the Japan Monkey Centre in 1957, and since then they have united to form a group (KAWAI & ITANI, 1957; KAWAI, 1960). The group consisted of about 130 animals in June, 1969. All animals have been identified since the beginning of group formation.

RESULTS

During the 12 years and 2 months from April, 1957, to June, 1969, which involves 13 birth seasons, 234 births in 66 females, including one twin birth, were recorded in the Ohirayama group. Table 1 shows the monthly distribution of births for each year. It is apparent from the table that the Japanese monkey is a seasonal breeder, as the births were observed to be concentrated in the four consecutive months from

Table 1. Birth season of Ohirayama group.

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1957				5	1	2	1						9
1958				1	3		1						5
1959			1	3	1				1				6
1960			1	4	8	5							18
1961			1	3	8	1							13
1962			1	4	14	4							23
1963				2	8	3	1						14
1964			4	14	6	1							25
1965			2	5	10	2	1			1			21
1966		1	1	18	6	1	1						28
1967			1	3	16	2	4						26
1968			2	12	6	4			1				25
1969			2	7	10	2							21
Total		1	16	81	97	27	9		2	1			234

March to June. Of the total 234 births, those whose days of interbirth interval were countable were 168; of the remaining, only first births were observed. The distribution of frequency of the preceding interbirth interval in these 168 births is represented by a histogram in Figure 1. In this figure, the interbirth intervals, ranging from 282 days to 1,113 days, were divided into 30 class intervals, each of which had a 29-day width. As may be observed in this figure, the distribution shows two distinct peaks. The first peak is found in the range of from 282 to 458 days of interbirth interval. As far as this group is concerned, the mean interbirth interval was found to be 365.43 days, the standard deviation being 46.95 days. The second peak occurs in the range of from 556 to 807 days. This group of interbirth intervals gives 721.33 days as the mean and 37.38 days as the standard deviation. Distribution having two such peaks reveals that the female in this group gives birth to young at an interval of one or two years. Though some births were found at an interval of three-years, as shown on the right of the figure, the frequency of such cases was extremely low. Among the 168 cases, the births with an interval of approximately one year numbered

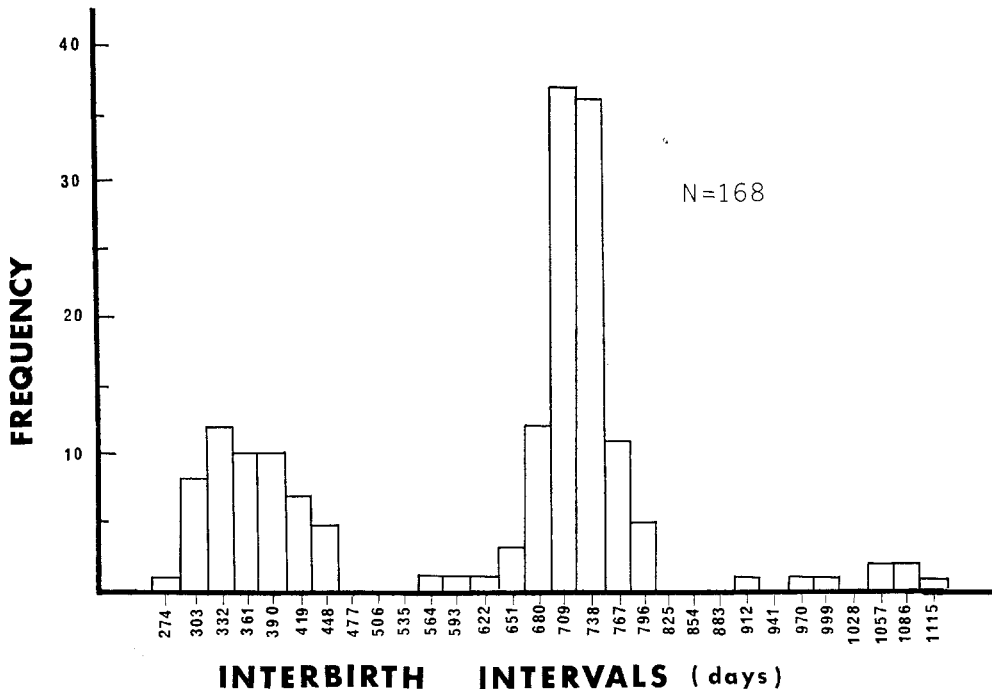


Fig. 1. Histogram of interbirth intervals.

53 cases (31.5%), while those with an interval of approximately two years numbered 107 cases (63.7%). Thus, as far as this group of monkeys is concerned, births with a two-year interval seem to be more general.

To ascertain the possibility that births with a one-year interval may occur more frequently if young are lost earlier, an interval of 365 days was used as a criterion for observing the shorter interbirth interval, since the mean of the so-called one-year interval is 365.43 (Fig. 1). It is clear that the period during which the loss of young practically affects the length of interval till the subsequent birth must be shorter than 365 days because this period contains a gestation period of a certain length as an inevitable physiological process. As the gestation period of Japanese monkeys has been estimated as approximately 180 days, a figure obtained by subtracting 180 days from 365 days, that is, 185 days, seems to be an estimate of the period during which the loss of young may thereafter affect the reproductive cycle of the mother in some way. Accordingly, the postpartum loss of young which occurred within 185 days after birth is defined in the present report as *infant loss*.

Among the 168 births whose interbirth intervals are countable, those that resulted in infant loss numbered 40, of which 38 females (95%) gave subsequent birth in the following year. The births in which infant loss did not occur amounted to 128. Only 11 (8.6%) of these 128 females gave subsequent birth in the following year. It is clear, therefore, that births followed by loss of young are more frequently followed by subsequent births in the following year than are those having no infant loss.

DISCUSSION

Inhibitory effects of lactation on follicular development are well known in many species of sub-primate mammals. Even in human females an atrophy of the vaginal epithelium indicating a lack in ovarian estrogen has been observed during lactation (YOUNG, 1961). Furthermore, it has been reported in mice and rats that the blastocysts developing during lactation fail to implant in the uterus at the proper time, resulting in delayed implantation (BRAMBELL, 1937; WEICHERT, 1940, 1942; WHITTEN, 1958). On the other hand, it has been demonstrated in rabbits (HAMMOND & MARSHALL, 1925) and in rats (SELYE, 1934) that the mammary glands became inactive and ceased their function of milk secretion when the young were removed from the mother. These findings imply that removal of the young from the mother during her lactation period may cause the cessation of lactic secretion and subsequently hasten the resumption of normal ovarian functions. A similar fact was reported by KOFORD (1965, 1966) in his study of rhesus monkeys on Cayo Santiago, Puerto Rico. He noted that birth distribution in any year was affected by the survival of infants from the previous year because multiparous females losing their infants due to postnatal mortality or failure in reproduction and therefore nonlactating females tended to mate and give birth earlier than those lactating. The results of the present study concerning the relationship between the interbirth interval and the loss of young in Japanese monkeys seem to support this presumption, though physiological or hormonal bases underlying the phenomena remain to be studied.

KAWAI (1969) previously noted that a two-years' interval between births is most frequent in Ohirayama (about 72% of 82 instances) and that if females lose infants they tend to give birth in the following year (12 out of 18 females who gave birth in two consecutive years lost their infants the previous year). The results of the present study indicate that his findings, based on a small sample, are confirmed and reinforced by the larger size of the sample which has been accumulated thereafter.

An argument may also be raised in relation to the physiological time of weaning in this species. In the pig-tailed macaque (*Macaca nemestrina*) lactation lasted 8 months, though the infant continued to suck for nearly a year (ZUCKERMAN, 1931). It has been generally thought that lactation in Japanese monkeys lasts about six or seven months in a wild situation, although 3 month old infants can eat solid food. If six or seven months of lactation are presumed, most lactating mothers will resume their menstrual cycle before or during the mating season, irrespective of whether her infant is alive or lost. This should yield a predominant occurrence of births at a one-year interval, but this does not represent the actual fact, for births occur more frequently at two-year intervals.

The present analysis on the relation between the loss of infant and the interbirth interval indicates that separation of infants from their mothers increases the reproductive ability of the latter, and, for the purpose of increasing reproduction, this separation should be made at the latest, within 185 days after parturition; in other words, before or during the following mating season, for Japanese monkeys.

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Authors' Present Addresses: TOSHIO TANAKA and SHIGETAKA KOTERA, *Japan Monkey Centre, Inuyama, Aichi, Japan*; KISABURO TOKUDA, 31A-408, *Shimotanabe-danchi, Takatsuki, Osaka, Japan*.