Growth of Golden Hamster and Rat Young Reared by Foster Mothers of the Reciprocal Species

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Growth of Golden Hamster and Rat Young Reared by Foster Mothers of the Reciprocal Species

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Summary

Partial exchange of litter was attempted between rat and golden hamster to examine the effect on their survival and growth when reared by foster mothers of alien species. When the hamster young of 6 days of age were introduced to the lactating rats of 3 to 12 days post-partum, 33 of 90 young survived through weaning. Their mean body weight at the weaning (21 days of age) was 26 g, equivalent to 64% of that of control hamsters reared by their own mothers. Although less successful in the rearing of rat young by hamster foster mothers, 12 of 25 young survived through weaning, when they were introduced at 6 to 8 days of age to the lactating hamster of 6 days post-partum. The mean body weight at the weaning (21 days of age) was 17 g, equivalent to 40% of that of control rats. The results indicate that both laboratory animals, particularly rats, may be able to act as foster mothers to the young of the alien species under optimum conditions.

Care of the young is crucial event in the reproductive life of any mammal (1). However, maternal behavior has been observed occasionally even for an infant of alien species. Parkes (2) and Denenberg et al. (3) reported growth on the mouse young which were successfully reared by foster rats. Several species of domestic birds accept young of another bird (4). Such evidence provides not only a zoological interest, but also suggestive information on the utilization of foster mothers in the animal industry.

Referring to limited information, this study was undertaken to observe the survival and growth of golden hamster and rat young, after introducing them to a lactating animal of the reciprocal species.

Materials and Methods

Wistar strain rats and golden hamsters were used. They were kept in cages in a breeding room at 25°C, illuminated from 6 : 00 to 18 : 00 hours. Food and water were supplied ad libitum. Several young of 0 to 12 days of age were picked up from a litter to be reared by foster mothers of the reciprocal species, which

consisted of lactating rats of 0 to 12 days and lactating golden hamsters of 0 to 9 days post-partum. The ages of young did not always coincide with the post-partum days of their foster mothers.

Process of introducing young to their foster mothers of alien species was as follows. First, lactating mother animals were removed carefully from their own cages. Then, several young (4 to 6) were taken out from their litter with tweezers and the same number of young of the alien species were introduced instead. Finally, the lactating animals were brought back into their own cages. Thus, the lactating animals were forced to live with the young of another species as well as her own left as control. From then on daily observation on the nursing behavior of the lactating amimals and the weighing of young were carried out until the latter reached puberty. At weaning at 21 days of age, examination of the signs of puberty was initiated for the female young by the vaginal opening in rat and by the appearance of vaginal discharge in golden hamster.

Results

1. *Rearing of golden hamster young by foster rat mothers*

Most of the lactating rats accepted golden hamster young as their own without rejection. They assumed a nursing posture and licked all the young evenly. The hamster young attached to the nipples of the foster rat easily. The next day, however, the former were sucking weakly or had already died. Neverthless, some of them survived for a period, which varied according to the age of grouping with the foster rats (Table 1). Thus, the hamster young reared by the foster rats shortly after birth survived for only one day maximum. The young of 1/2, 1, 2 and 3 days of age survived for two, three, two and one more day maximum, respectively. The young of 4 and 5 days of age were alive for one to two more weeks, and of the young of 6 days of age, 33 of 90 survived through weaning, when introduced to the foster rats of 3 to 12 days post-partum. Daily gain in body weight was slow until about 14 days of age, thereafter showing a similar rate to the control young reared by their own mother (Fig. 1). The mean body weight at the weaning was 26 g, equivalent to 64% that of the control animals. The appearance of vaginal discharge was recognized at about 32 days of age as in the control animals, but the body weight at this time was significantly lighter in the experimental group (Table 2).

2. *Rearing of rat young by foster golden hamster mothers*

Most of the lactating golden hamsters snapped at the rat young when they were grouped, although some hamsters displayed fostering behavior. The rat young of 0 to 5 days of age grouped with lactating hamster survived only five more days in maximum. However 12 of 25 young survived through weaning when they were introduced at 6 to 8 days of age to foster hamsters of 6 days post-partum

TABLE 1. *Maximum Survival Days of Hamster Young after Initiation of Fostering by Lactating Rat*

Days of age of hamster young	Post-partum days in foster rats													
	0	1/2	1	2	3	4	5	6	7	8	9	10	11	12
0	1 (1/16)				1 (1/2)									
1/2		2 (1/2)	1 (2/13)		1 (4/40)	1 (2/19)	1 (1/3)							
1		1 (1/6)				3 (3/9)	1 (2/9)							
2		2 (1/4)	1 (5/9)			1 (10/10)								
3			1 (5/16)											
4										13 (2/8)	13 (1/9)			
5							1 (0/2)	7 (4/20)						
6					>15 (4/13)	3 (3/3)	>15 (5/23)	>15 (13/36)	>15 (7/8)	>15 (2/4)				>15 (2/3)
7							>14 (1/11)		4 (4/12)	1 (6/12)				
8			5 (1/6)					>13 (1/8)						
9			2 (1/2)											
10			2 (1/2)		5 (1/1)									
11			2 (2/7)			2 (2/3)								

Figures in parentheses mean $\frac{\text{number of young surviving for the maximum days}}{\text{total number of young}}$ in each group.

TABLE 2. *Attainment of Puberty in the Female Golden Hamster and Rat Young which were Successfully Reared by Foster Mother of the Reciprocal Species*

	Hamster young reared by		Rat young reared by	
	foster rat	mother hamster	foster hamster	mother rat
Number of young	9	9	4	10
Age at puberty (days)	31.6±0.3	32.4±0.3	44.3±0.7[b]	37.1±0.8[b]
Body weight at puberty (g)	52.5±1.1[a]	79.5±1.4[a]	90.8±2.3	90.0±4.3

Values are Means±S.E.
Figures in the same rows with same superscript letters are significantly different, $p<0.001$.

(Table 3). The mean body weight of rat young successfully reared by the foster hamsters rather decreased from 8 to 18 days of age, then increased to some extent (Fig. 2). As a result, body weight at weaning was 17 g, 40% that of the control young. Opening of the vagina in the experimental group was delayed 6 to 9 days,

TABLE 3. *Maximum Survival Days of Rat Young after Initiation of Fostering by Lactating Hamster*

Days of age of rat young	Post-partum days in foster hamster									
	0	1/2	1	2	3	4	5	6	7	8
0	1 (2/26)									
1/2		5 (1/6)	3 (1/6)	5 (2/7)						
1		4 (2/8)			4 (1/8)					
2										
3		5 (3/10)								
4		5 (2/4)								
5			1 (1/9)							
6			5 (1/3)					>15 (7/19)		
7								>14 (3/4)		
8			3 (1/5)					>13 (2/2)		

Figures in parentheses mean $\frac{\text{number of young surviving for the maximum days}}{\text{total number of young}}$ in each group.

TABLE 4. *Difference in Milk Composition between Rat and Golden Hamster [Jenness (5)]*

Animals	Percent					
	Total solids	Fat	Casein	Whey protein	Lactose	Ash
Norway rat	21.0	10.3	6.4	2.0	2.6	1.3
Golden hamster	22.6	4.9	6.7	2.7	4.9	1.4

but the body weight at that time was about 90 g, as in the control animals (Table 2).

Discussion

The relationship between mother and infant, as well as milk characteristics, is an inevitable factor for the survival and growth of young. In this respect rearing by a foster mother, particularly from alien species is problematic. Neverthless, the present experiment showed a possibility that both rat and golden hamster were available as foster mothers to the young of the reciprocal species under optimum conditions. Of these two species, rat was superior to golden

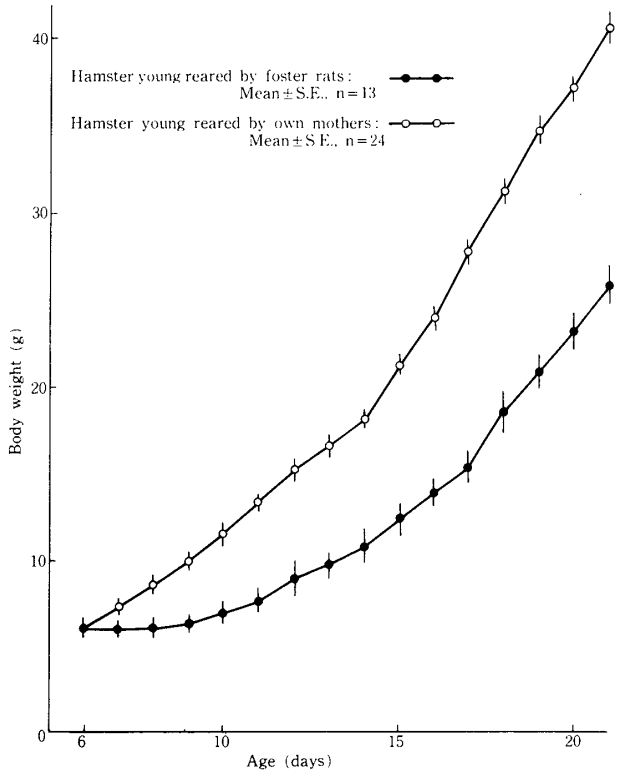

FIG. 1. Growth curve of hamster young successfully reared by foster rats.

hamster in that ability, from the viewpoint of the maternal behavior and the survival and growth of the infants fostered. Parkes (2) found that the amount of milk of lactating rat enabled mice to reach the adult weight. Milk composition may be another factor, since fat percentage in rat milk is double that of golden hamster, whereas lactose percentage in the former is about half (Table 4) (5). Hence, it is evident that the species difference in either survival or growing curve of young mainly depends on the factors on the side of the foster animal.

Compared with control young reared by their own mothers, puberty in the fostered animals was attained at nearly the same age but in lighter body weight in golden hamster and at slightly advanced age but in nearly same body weight in rat. This may also represent the difference in the indicator of puberty between these species under the present experimental condition.

The present observation lacks continuous data on the ages of young and the post-partum days of foster animals. However, all young, which survived through weaning in the fostered group, needed nursing by their own mother during the first few days after birth. Denenberg et al. (6) observed that maternal behavior during the first few hours of life was critical for survival and growth in the rat young reared by a foster rat. This process might be inevitable for supply of colostrum from their own mothers for the young to be fostered and for the

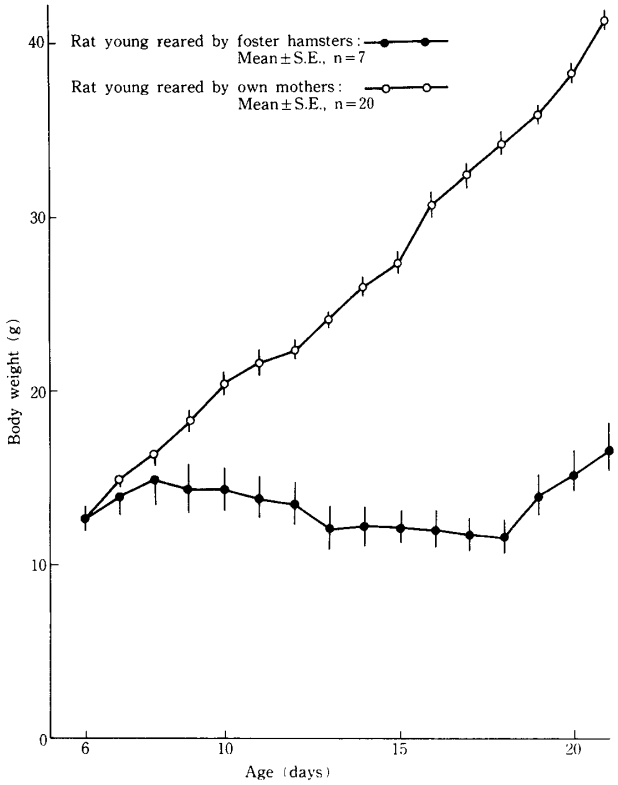

FIG. 2. Growth curve of rat young successfully reared by foster hamsters.

establishment of nursing behavior in the mother animal. Also it appears that not whole but partial exchange of litter has contributed to the successful fostering in this study.

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