

INBREEDING EFFECTS UPON GROWTH AND MATERNAL ABILITY IN LABORATORY MICE

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ABSTRACT

The effects of systematically increasing levels of inbreeding upon growth and postnatal maternal ability were determined in laboratory mice by utilizing the reciprocal crossfostering technique. Two experiments were conducted. The first included postnatal dams which were inbred 0, 12, 25 and 38% while corresponding levels in the litter were 0, 22, 38 and 50%, respectively. The second experiment included 0, 25, 50 and 73% inbred dams with litters inbred 0, 38, 59 and 79%, respectively. Increasing the level of inbreeding was found to linearly depress postnatal maternal performance. Young which had been suckled by the more inbred dams were smaller at 12 and 21 days of age than those which had been nursed by the more outbred dams. In the second experiment, these effects were carried over into the postweaning period. Increasing levels of inbreeding in the litter significantly depressed birth weight and weight at 12, 21, 42 and 56 days. The depressing effects of inbreeding in the litter were primarily linear for both males and females under the conditions of the more moderate levels of inbreeding included in the first experiment, but were curvilinear for females and linear for males in the second experiment. The curvilinearity in females was due to the general lack of depression until inbreeding had reached 50 to 60%, after which significant inbreeding depression developed.

INBREEDING has been shown to depress growth and maternal or lactational ability in domestic livestock (BERESKIN *et al.* 1968, 1970; DINKEL *et al.* 1968; YOUNG *et al.* 1969). However, in most cases, the effects of inbreeding have been confounded with time trends and with other environmental effects. Additionally, effective separation of the effects of inbreeding on maternal performance from the effects of inbreeding upon growth of the offspring has been difficult in domestic species. Inbreeding depression has been implicated as an explanation for asymmetry of response to bidirectional selection (FALCONER 1953) and as a possible reason for unusual or unexpected correlated responses to selection for body weight in laboratory mice (WHITE, LEGATES and EISEN 1968). Although many highly inbred lines of mice have been developed, little research has been reported on the magnitude and nature of the effects of increasing levels of inbreeding upon growth of the young and upon the maternal ability of the postnatal dam. Therefore, this study was conducted with the objective of character-

izing the effects of systematic increases in inbreeding upon growth of young mice and maternal ability in lactating females.

MATERIALS AND METHODS

Inbred lines of mice utilized in this investigation were developed from a large, outbred population of ICR albino mice originally obtained from the Institute for Cancer Research, Philadelphia.

Laboratory procedures: The reciprocal crossfostering technique utilized was similar to that shown by WHITE *et al.* (1968) to be suitable for studying independently differences in growth and postnatal maternal ability among genetically divergent lines of mice. Two experiments were conducted. The first (Experiment I) examined the effects of moderate levels of inbreeding by utilizing dams inbred 0, 12.5 (cited hereafter as 12) 25 and 37.5% (cited hereafter as 38%) whose offspring were inbred 0, 22, 38 and 50%, respectively. The second experiment (Experiment II) was concerned with more intensive levels of inbreeding with dams inbred 0, 25, 50 and 73.4 (cited hereafter as 73%) whose offspring were inbred 0, 38, 59 and 78.5 (cited hereafter as 79%). The various levels of inbreeding in the postnatal dams were developed by mating paternal half sibs for one generation (12%) and through one (25%), two (38%), three (50%) and six (73%) generations of full sib matings. Only first litters were used. At birth, four dams, one each from 0, 12, 25 and 38% inbred groups in Experiment I or one each from 0, 25, 50 and 73% inbred groups in Experiment II that had littered within the same 12-hr interval were assigned to each crossfoster group. Each dam was then given two of her own young and two from each of the other three dams in her group. The remainder of the young were discarded. Newborn litters were sexed, standardized to eight, and each mouse was identified for genetic line by toe clipping. Offspring were weighed individually and randomly assigned to a postnatal dam in their particular crossfoster group. Fifty-five crossfoster groups were formed from 220 litters in Experiment I and 26 crossfoster groups were formed from 104 litters in Experiment II. There were 28 half-sib families represented in the dams inbred 12%, 26 full-sib families represented in the 25% inbred dams and 43 full-sib families represented in the 38% inbred dams in Experiment I. In Experiment II, 12 full-sib families were represented in the 25% group, 15 in the 50% and 11 in the 73% inbred dam group. With the large number of families represented, actual levels of inbreeding should have closely approximated those calculated from theoretical considerations (WRIGHT 1922).

At 12 days of age, individual body weights were recorded, and the young were permanently identified by toe clipping. Mice were weaned at 21 days and weighed individually. At weaning four mice of the same sex and level of inbreeding were randomly assigned to a cage, with the restriction that each cage contained mice from more than one litter. Individual body weights were recorded at 42 and 56 days of age. Only data from mice which survived to 56 days of age were included in the analysis. This restriction eliminated less than 6% of the data from Experiment I and 11% from Experiment II. Table 1 shows the distribution of surviving mice among levels of inbreeding in the litter (F_L) and in the postnatal dam (F_D). Although there was a tendency for fewer survivors at the higher levels of inbreeding, chi-square tests indicated that the cell frequencies were homogenous. Apparently, even the more inbred dams readily maintained litters of eight mice. All mice were fed standard commercial breeding and growth rations and the laboratory was maintained at approximately 22°C with a light-to-dark ratio of one.

Statistical techniques: The experimental design utilized was a randomized complete block with the four levels of inbreeding in the postnatal dam (F_D) and the four levels in the offspring (F_L) arranged factorially in each block (crossfoster group). The two experiments were analyzed separately according to the following model:

$$Y_{ijklm} = \mu + g_i + s_j + a_k + p_l + (sa)_{jk} + (sp)_{jl} + (ap)_{kl} + e_{ijklm}$$

when μ represents the general mean; g_i is the effect of the i th crossfoster group ($i = 1, 2, \dots, 55$ for Experiment I, and $i = 1, 2, \dots, 26$ for Experiment II); s_j is the effect of j th sex ($j = 1, 2$); a_k

TABLE 1

Number of mice in each F_D - F_L subclass surviving to 56 days of age

Inbreeding of litter, F_L , percent	EXPERIMENT I Inbreeding of dams, F_D , percent				Total
	0	12	25	38	
0	108	105	108	108	429
22	103	101	105	101	410
38	103	100	102	99	404
50	105	103	104	103	415
Total	419	409	419	411	1658

Inbreeding of litter, F_L , percent	EXPERIMENT II Inbreeding of dams, F_D , percent				Total
	0	25	50	73	
0	48	46	46	40	180
38	51	48	45	50	194
59	47	47	49	46	189
79	43	46	44	43	176
Total	189	187	184	179	739

is the effect of the k th level of inbreeding in the litter (F_L) ($k = 1, 2, 3, 4$); p_l is the effect of the l th level of inbreeding in the postnatal dam (F_D) ($l = 1, 2, 3, 4$); $(sa)_{jk}$ and $(sp)_{jl}$ represent interactions of sex with F_L and F_D , respectively; $(ap)_{kl}$ represents the interaction of F_L with F_D and e_{ijklm} represents the random error within subclasses. The g_i and e_{ijklm} were assumed to be independent random variables with zero means and variances σ_g^2 and σ_e^2 , respectively. The remaining effects were assumed to be fixed. Due to unequal subclass numbers, methods as outlined by HARVEY (1950) were used. Linearity of the a_k and p_l were determined by multiple regression procedures. Equations for crossfoster group-sex subclasses were absorbed by least squares, and the corrected sums of squares and cross-products were examined for linear and quadratic effects of F_L and F_D simultaneously, for each of the various traits. This procedure results in the regression analysis being conducted within crossfoster-sex subclasses which assumes that the individual regressions for each of the 110 crossfoster-sex subclasses in Experiment I and 52 subclasses in Experiment II were homogenous. Although no specific test of this assumption was made, analyses were completed within crossfoster groups for each sex separately and are reported along with the pooled analysis. The linear effect of total number born in the litter was included as a covariate for birth weight. Statistical significance of the polynomial regressions was tested by procedures outlined by KEMPTHORNE (1952).

RESULTS AND DISCUSSION

Prewearing traits: Means and standard errors for birth, 12- and 21-day weight for Experiments I and II are shown in Tables 2 and 3, respectively. Corresponding analyses of variance are presented in Tables 4 and 5. Due to the apparent tendency toward a correlation between the mean and the variance, all data were converted to common logarithms for analysis. However, the results and inferences drawn were identical to those obtained from the analysis of the original data. Therefore, only the analysis of the original data will be presented. Mean squares for linear and quadratic effects in Tables 4 and 5 are those derived from multiple regression techniques described earlier. Partial regression coeffi-

TABLE 2

Means of individual body weights for Experiment I

Inbreeding of litter, F_L	Birth weight*	12-day weight	21-day weight	42-day weight	56-day weight
0	1.66	8.56	15.21	29.90	32.69
22	1.65	8.26	14.53	29.85	32.42
38	1.67	8.14	14.26	29.17	31.76
50	1.67	8.08	14.25	29.53	31.97
Inbreeding of dam, F_D					
0	1.67	8.35	14.64	29.69	32.31
12	1.67	8.29	14.60	29.58	32.08
25	1.67	8.31	14.67	29.71	32.35
38	1.66	8.09	14.35	29.46	32.09
Std. errors†	0.01	0.05	0.08	0.14	0.16

* Mean birth weight adjusted for linear effects of litter size at birth.

† Standard errors for all means in the same column.

coefficients derived from fitting linear effects of increasing levels of inbreeding in the litter (F_L) and in the dam (F_D), and coefficients derived from fitting both linear and quadratic effects within sex-crossfoster group subclasses and separately for each sex are presented in Table 6. Regressions fitted with only linear effects considered indicated the direction and average magnitude of the effects of inbreeding. The second set included coefficients for both linear and quadratic effects, when quadratic effects were statistically significant, and yielded information relative to the genetic nature of the effects of inbreeding in the litter and postnatal dam. Since no quadratic effects of F_D were significant in Experiment I, these coefficients were not listed in Table 6.

No significant differences were noted for birth weight in Experiment I due to

TABLE 3

Means of individual body weights for Experiment II

Inbreeding of litter, F_L	Birth weight*	12-day weight	21-day weight	42-day weight	56-day weight
0	1.61	7.67	13.25	29.76	31.18
38	1.64	7.56	12.96	29.39	31.24
59	1.60	7.54	12.78	28.52	30.50
79	1.52	6.72	11.59	27.58	29.47
Inbreeding of dam, F_D					
0	1.60	7.81	13.02	29.50	31.30
25	1.59	7.27	12.54	28.60	30.28
50	1.60	7.32	12.63	28.61	30.52
73	1.58	7.10	12.39	28.55	30.29
Std. errors†	0.01	0.06	0.13	0.18	0.20

* Mean birth weight adjusted for linear effects of litter size at birth.

† Standard errors for all means in the same column.

TABLE 4

Analyses of variance for individual body weight for Experiment I

Source	df	Mean squares				
		Birth weight	12-day weight	21-day weight	42-day weight	56-day weight
Groups	54	0.20	14.34	43.85	82.63	85.16
Sex (S)	1	2.61**	15.79**	180.35**	17895.47**	24957.65**
F _L	3	0.05	19.46**	84.65**	47.20**	73.28**
Linear	1		56.45**	237.38**	78.80**	182.40**
Quadratic	1		2.66	24.33**	0.84	2.08
F _D	3	0.03	5.58**	8.61**	5.74	8.42
Linear	1		12.02**	12.50*	5.89	1.33
Quadratic	1		2.87	8.76	2.62	0.13
S × F _L	3	0.02	0.73	8.12**	18.78	39.04**
S × F _D	3	0.01	0.74	2.18	6.78	3.28
F _L × F _D	9	0.01	0.24	0.99	5.26	4.47
Error	1581	0.02	0.94	2.90	8.46	10.27

* Statistically significant ($P < 0.05$).
 ** Statistically significant ($P < 0.01$).

F_L even though number born in the litter was fitted as a covariate. Number born in the litter was linearly and inversely related ($P < .01$) to individual birth weight ($b = .009$). Average litter size for the 0, 12, 25 and 38% inbred dams was 13.8, 12.4, 12.5 and 12.1, respectively. Apparently, the depressing effects of the levels of inbreeding included in Experiment I upon individual birth weight were not great enough to overcome the compensating effects of smaller litters born to the more inbred dams. In Experiment II, individual birth weight re-

TABLE 5

Analyses of variance for individual body weight for Experiment II

Source	df	Mean squares				
		Birth weight	12-day weight	21-day weight	42-day weight	56-day weight
Groups	25	0.26	6.55	27.56	25.54	28.44
Sex (S)	1	0.32**	6.36**	61.30**	5846.54**	7023.17**
F _L	3	0.33**	34.77**	95.00**	172.10**	122.26**
Linear	1		0.47**	59.85**	196.19**	425.19**
Quadratic	1		0.74**	30.75**	56.53**	63.77**
F _D	3	0.03	15.94**	12.54**	36.44**	40.67**
Linear	1		36.82**	26.53**	70.80**	63.22**
Quadratic	1		3.79*	1.88	22.00	24.04
S × F _L	3	0.05	0.88	5.20	21.62*	21.91*
S × F _D	3	0.01	0.73	2.76	4.70	2.23
F _L × F _D	9	0.01	0.52	1.57	2.78	3.75
Error	691	0.02	0.71	3.16	6.25	7.73

* Statistically significant ($P < 0.05$).
 ** Statistically significant ($P < 0.01$).

TABLE 6
Regression coefficients and other statistics for Experiments I and II

Independent variable ^a	12-day weight			21-day weight			42-day weight			56-day weight		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
EXPERIMENT I												
F _L linear ^b	-.100**	-.102**	-.097**	-.204**	-.228**	-.179**	-.118**	-.148**	-.086	-.179**	-.246**	-.109*
F _D linear ^b	-.061**	-.066**	-.056**	-.062*	-.083*	-.041	-.043	-.082	-.010	-.020	-.082	.040
F _L linear ^c				-.178**	-.197**							
F _L quadratic ^c				.044**	-.051*							
R ^{2d}	.044	.047	.042	.052	.072	.052	.012	.010	.030	.014	.019	.026
EXPERIMENT II												
F _L linear ^b	-.100**	-.093**	-.106**	-.180**	-.183**	-.176**	-.264**	-.315**	-.208**	-.196**	-.245**	-.142**
F _D linear ^b	-.084**	-.078**	-.090**	-.071**	-.078*	-.065	-.117**	-.145**	-.086	-.110**	-.106	-.112*
F _L linear ^c	-.137**	-.041**	-.031**	-.231**		-.048**	-.318**		-.040**	-.267**		.043**
F _L quadratic ^c	-.031**	-.025**	-.038**	-.042**		-.064**	-.045**		-.085**	-.058**		-.093**
F _D linear ^c	-.076**		-.154**									
F _D quadratic ^c	.012*		-.018*									
R ^{2d}	.208	.193	.229	.115	.113	.127	.123	.140	.135	.077	.073	.105

^a All inbreeding (F) values are in units of 10% inbreeding.

^b Partial regressions when only the linear effects were included in the model.

^c Partial regressions for linear and quadratic effects.

^d R² values for model including linear and quadratic effects.

* Statistically significant (P < 0.05); ** Statistically significant (P < 0.01).

mained stable for offspring born to 0, 25 and 50% inbred dams, but declined markedly in litters born to 73% inbred dams (offspring inbred 79%). Average litter sizes in Experiment II for dams inbred 0, 25, 50 and 73% were 14.8, 13.4, 11.8 and 11.8, respectively. The depressing effects of inbreeding overcame the compensating effects of smaller litter size in dams inbred 73% resulting in significant differences among mean birth weights of individual mice in Experiment II. WHITE *et al.* (1968) demonstrated that in using the crossfostering technique, the effect due to F_L represents not only differences in weight due to genetic effects of increasing levels of inbreeding in the offspring, but also any prenatal maternal (intrauterine) differences among prenatal dams that might be carried over into the postnatal period. Birth weight was not noticeably affected by these effects in Experiment I, probably due to the compensating effects of fewer born with slightly heavier birth weights. Since offspring were randomly assigned to postnatal dams at birth, there were no significant differences in birth weight due to F_D .

Twelve-day weight was significantly depressed by increasing levels of inbreeding in both the litter (F_L) and postnatal dam (F_D) in both experiments. Linear effects were sufficient to explain the response to increasing levels of inbreeding in the postnatal dam (F_D) in Experiment I (Table 4) while quadratic effects were significant for the high levels of inbreeding examined in Experiment II (Table 5). It should be noted that 12-day weight in Experiment II was the only trait measured that showed a significant quadratic response due to F_D . Therefore, it is likely that increasing levels of inbreeding generally resulted in a linear depression in postnatal maternal performance. This conclusion is in agreement with YOUNG *et al.* (1969) who found that increasing levels of inbreeding linearly depressed milk production in dairy cattle. The means in Tables 2 and 3 indicated that the depressing effects of inbreeding in the postnatal dam were slightly more severe in Experiment II. Offspring which had been suckled by dams inbred 0, 12 and 25% showed little variation in 12-day weight in Experiment I, while in Experiment II, offspring which had been suckled by 25% inbred dams were considerably smaller at 12 days than those which had suckled outbred dams.

The effect of inbreeding in the postnatal dam should be at its peak when the litter is 12 days of age because the young do not open their eyes until they are 12 or 13 days old and depend upon their dam for all nourishment during this period. However, the regression coefficients in Table 6 indicated that the depressing effects of F_L were 30 to 40% greater than F_D . For example, at 30% inbreeding in Experiment I, individual mice would be expected to weigh 0.30 g less than outbred mice at 12 days of age due to F_L , while 30% inbreeding in the postnatal dam would be expected to further depress 12-day weight in the offspring by another 0.18 g, other things being equal. These results agree with those of BERESKIN *et al.* (1968) and SWIGER *et al.* (1961) who found similar results for swine and beef cattle, respectively. They also confirm the hypothesis advanced by WHITE *et al.* (1968) that inbreeding depression was at least a partial cause of reduced postnatal maternal ability among dams subjected to long term selection for increased six-week body weight. They showed that the postnatal maternal

performance of dams selected for increased body weight at six weeks of age for 40 generations, and in which inbreeding had accumulated to 40%, was inferior to that of outbred controls.

The absence of significant interactions for sex by F_L (Tables 4 and 5) and the similarity of regressions for both sexes (Table 6) indicated that the effects of inbreeding on weight at 12 days were similar for males and females. There was no tendency for one sex to be depressed more than the other.

The absence of significant $F_L \times F_D$ interactions for 12-day weight indicated that the effects of crossfostering *per se* were negligible. These results agree with those of WHITE *et al.* (1968), who found little evidence of preferential treatment when crossfostering among dams of different selected lines with standardized litter size, and NAGAR, LEE and HICKMAN (1971) who found similar results when crossfostering among inbred and outbred dams. Similar conclusions can be drawn with reference to the $S \times F_D$ interaction. Even though males were significantly larger females at 12 days of age, postnatal dams apparently treated male and female offspring similarly. There was apparently very little active competition for nourishment from birth to 12 days in litters of eight mice.

Weight at 21 days (weaning weight) was significantly depressed by increasing levels of inbreeding in the litter (F_L). Mean squares (Tables 4 and 5) and partial regressions (Table 6) indicated significant linear and quadratic effects of inbreeding in the litter upon weaning weight. These results are in agreement with those of BERESKIN *et al.* (1968, 1970), who found significant curvilinear effects of inbreeding in the litter upon weaning weight in swine, but found that only linear effects of inbreeding in the dam were significant. The means in Tables 2 and 3 indicated that the overall depressing effects of inbreeding in the litter were evident from 0 to 22%, less severe from 22 to 59% and were severe from 59 to 79%, resulting in the significant curvilinear effects. Effects of inbreeding in the postnatal dam (F_D) upon weaning weight were significant but were small as evidenced by the linear regressions in Table 6. The linear regressions indicated that the depressing effects of F_L upon weaning weight were much greater than the depressing effects of F_D .

The sex by F_L interaction was significant for weaning weight in Experiment I (Table 4). This interaction developed from a sex difference in the response to inbreeding in the litter (F_L) (Table 7). While not statistically significant, similar patterns of response may be observed in Table 7 for male-female 21-day weights in Experiment II. In Table 7, Experiment I, male weight decreased 7.5% and female weight 5.0% as inbreeding increased from 0 to 50%. In Experiment II, male weight decreased 5.1% and female weight decreased 2.0% as inbreeding increased from 0 to 59%. Raising the level of inbreeding from 0 to 50 or 60% appeared to have a greater effect on males than females. However, raising the level of inbreeding from 59 to 79% reduced male weaning weight an additional 7.1% while female weight was reduced an additional 11.6%. Therefore, systematic increases in inbreeding apparently had an immediate and rather consistently depressing effect upon males, while female weaning weight appeared to remain more stable until inbreeding reached 50 to 60% after which the

TABLE 7

Weights of males and females at various levels of inbreeding in the litter (F_L)

Level of inbreeding	21-day weight		42-day weight		56-day weight	
	Males	Females	Males	Females	Males	Females
EXPERIMENT I						
0	15.66	14.77	33.36	26.44	36.87	28.51
22	14.73	14.34	32.95	26.74	36.08	28.76
38	14.73	13.80	32.71	25.63	35.95	27.58
50	14.48	14.03	32.69	26.37	35.61	28.33
Std. error*	0.12	0.12	0.20	0.21	0.22	0.23
EXPERIMENT II						
0	13.66	12.84	33.05	26.47	34.71	27.66
38	13.07	12.85	31.98	26.81	34.25	28.24
59	12.97	12.59	31.10	25.94	33.22	27.77
79	12.05	11.13	30.59	24.56	32.79	26.15
Std. error*	0.19	0.19	0.26	0.26	0.29	0.30

* Standard errors for all means in the same column.

depressing effects were more drastic than in males. The total depression for increasing inbreeding from 0 to 79% was similar (11.8% for males and 13.3% for females) for both sexes. These results are not consistent with those of STONAKER (1963) who found the effects of inbreeding depression on weaning weight to be much greater in female than in male beef calves. However, variable responses among the sexes to inbreeding may be dependent upon the level of inbreeding attained. The $S \times F_D$ and $F_L \times F_D$ interactions were not significant for weaning weight. These results provided further evidence that postnatal dams treated male and female, native and fostered mice similarly and that the effects of crossfostering *per se* were negligible.

The R^2 values in Table 6 indicated that 4 to 23% of the variation in preweaning growth can be accounted for by inbreeding. These results are similar to those previously published for domestic livestock (BERESKIN *et al.* 1968, 1970; DINKEL *et al.* 1968). A greater proportion of the variation in growth was accounted for by higher levels of inbreeding than by lower levels.

Postweaning traits: Means for the postweaning traits are shown in Tables 2 and 3 while appropriate mean squares and regressions are shown in Tables 4, 5 and 6, respectively. Males were significantly larger than females at all stages of growth. No significant differences for either postweaning trait were detected among offspring that were suckled by outbred postnatal dams and those that had been nursed by the more inbred dams in Experiment I. The regressions in Table 6 were not significant, but consistently showed a tendency for those animals which had suckled the more inbred dams to be slightly smaller at 42 and 56 days of age. This indicated that, within the limits of Experiment I, the depressing effects of increasing levels of inbreeding upon postnatal maternal performance were not sufficient to influence postweaning growth. However, in Experiment II where inbreeding in the postnatal dam reached 73%, the depressing effects of inbreeding

upon the postnatal maternal performance of the more inbred dams significantly affected the weight at 42 and 56 days of offspring which they had suckled. These results are in agreement with those in swine (BERESKIN *et al.* 1968) where the depressing effects of inbreeding in the dam upon 156-day weight were significant.

The depressing effects of F_L were significant for weight at 42 and 56 days of age for both experiments. These results were similar to those of BERESKIN *et al.* (1968) who found significant depression in 154-day weight in swine due to inbreeding in the litter and those of DINKEL *et al.* (1968) who found significant reduction in 364-day weight of beef cattle due to inbreeding in the calf.

The effects of inbreeding in the litter upon postweaning traits were linear in Experiment I but were curvilinear in Experiment II. FALCONER (1960) has suggested that curvilinear responses could result from complex epistatic gene effects depending on interactions between dominance combinations. However, the regression coefficients (Table 6) revealed that the responses were linear for males in both experiments but were curvilinear for females in Experiment II. This variable response among the sexes was further verified by the significant $S \times F_L$ interactions for weight at 56 days, and approaching significance ($P < 0.10$) for 42-day weight in Experiment I. The interaction was significant for both postweaning traits in Experiment II. Inspection of the 42- and 56-day weight means in Table 7 revealed that male weights were linearly depressed by inbreeding while female weight was more stable and did not show inbreeding depression for either postweaning trait until the level of inbreeding had reached 59%. Males inbred 50.0% were 0.67 g smaller at 42 days and 1.26 g smaller at 56 days than outbred males while corresponding differences for females were only 0.07 g and 0.18 g, respectively. The end result of increasing inbreeding in Experiment II from 0 to 79% was a 7.4 and 7.2% decrease in the 42-day weight of males and females, respectively; and a 5.5% decrease in 56-day weight in both sexes. Therefore, although the mechanism of inbreeding depression may have been different among the sexes, the end result was basically the same.

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