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PLASMA CORTISOL AND BEHAVIOUR IN EARLY WEANED PIGLETS*

By

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WORSAAE, H. and M. SCHMIDT: *Plasma cortisol and behaviour in early weaned piglets.* Acta vet. scand. 1980, *21*, 640—657. — Comparisons were made of cortisol concentration and behavioural activity between piglets weaned at 3 weeks of age (early weaned piglets), and piglets weaned at 8 weeks of age (control piglets). Early weaned littermates were placed in cages with a floor area of either 0.20 m^2 per piglet or 0.15 m^2 per piglet. At 8 weeks of age, the piglets in the control litters were moved from the sow and early weaned piglets were moved from the cages. All litters were placed in pens, 1 pen for each litter. Radioimmunoassay was used for plasma cortisol determination. Behavioural activity included determination of play, aggressive behaviour and non-nutritive oral activity. Statistical analysis for possible association between plasma cortisol concentration and age, housing conditions, litter and sequence of capture of littermates for blood collection revealed a complex pattern. Generally, higher plasma cortisol concentrations and more aggressive and non-nutritive oral activity, but less playing activity, were associated with early weaning. Plasma cortisol concentration in individual piglets was positively correlated to both aggressive and non-nutritive oral behaviour, but was negatively correlated to playing behaviour. It is concluded that early weaning is a stressor.

cortisol; plasma; radioimmunoassay; piglets; early weaning; playing; aggression; non-nutritive oral behaviour.

Psychological stressors, such as novel environments, frustration, specific social stimuli, all lead to increased adreno-cortical function (*Mason* 1975, *Archer* 1979). Prolonged secretion of corticosteroids contributes to regression of the lymphoid tissues, depletion of adrenal ascorbic acid, change in protein metabolism, reduced growth and loss of weight (*Selye* 1974, *Freeman* 1975).

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Early weaned piglets in cages show unusual behaviour (*van Putten & Dammers* 1976, *Schmidt* 1977, *Fraser* 1978). These modifications of the normal behaviour may serve as a parameter for the well-being of the animals (*van Putten & Dammers*). Thus, the abnormal behaviour could be interpreted as a result of a stressfull situation.

The aim of this study was to evaluate the effect of early weaning of piglets and rearing in cages on plasma cortisol concentration and behaviour. Changes in these 2 parameters could be useful, as possible indicators of stress.

MATERIALS AND METHODS

Animals

At each of 3 replicating experiments, I—III, 3 littermate gilts of Danish Landrace were served by the same boar (different boars for the 3 experiments). In Replication IV, only 2 littermate gilts were bred to 1 boar. Thus a total of 11 litters were studied. Since intact litters of varying sizes made up the experimental groups, different numbers of piglets were included in each study.

Within 24 h after farrowing, the piglets were given numbers painted on their backs and tattooed on their ears. The piglets were studied from 2 to 9 weeks of age.

Housing

For each of the Replications I—III, the 3 litters were subjected to different housing conditions. One of these litters served as the control group, in which the piglets stayed with the sow in an 8 m^2 pen with straw bedding until 8 weeks of age. The other 2 litters were weaned at 3 weeks of age. Each of these 2 litters was then placed in a cage and remained there until 8 weeks of age. The floor area was 0.20 m^2 per piglet (cage 0.20) and 0.15 m^2 per piglet (cage 0.15), respectively for the 2 litters.

In Replication IV, 1 of the 2 litters served as control — and the other as cage 0.15 piglets.

At 8 weeks of age, all litters were moved to pens, 1 for each litter. The pens were supplied with straw bedding and had a floor area of 8 m^2.

Analysis for corticol

Blood samples were collected from each litter in all 4 replications up to 3 times weekly during the 3rd and 4th week of age,

twice weekly during the 6th and 8th week of age and once during the 9th week of age.

The piglets in each litter were caught at random and restrained for blood sampling. Blood was drawn from truncus bijugularis at 2 p.m. with a sodium-heparinized syringe and collected into sodium-heparinized tubes. Plasma was separated immediately and stored at —18°C. The time between capture and bleeding was less than 1½ min in 95 % of the cases.

The succession of capture of the piglets was recorded. The possible association between the plasma cortisol concentrations and the succession of capture was studied in the early weaned piglets held in the cages and in all piglets during the 9th week of age.

A radioimmunoassay for specific analysis of plasma cortisol concentrations was used (*Worsaae* 1980). The analysis included simple steps for removal of proteins and lipids from plasma. The tracer used was an ^{125}I-labelled cortisol-protein coupling product.

Behavioural observations

Behaviour was investigated in Experiments II—IV. Each litter was observed 4 times weekly the 3rd, 4th, 6th, 8th and 9th week of age, each observation period of 1 h duration.

The following behavioural patterns were recorded:

1) *Playing behaviour,* which consists of 2 activities:
   a) Playful fightings, which often involve more than 2 piglets and in which no aggressive elements are seen.
   b) Running around, in which the piglets finish a course of quick running by throwing themselves on the floor or against another piglet. This activity sometimes induces playful fightings.
2) *Aggressive behaviour,* which involves only 2 piglets and which consists of real fightings, bites and pushes.
3) *Non-nutritive oral behaviour,* which consists of 2 activities:
   a) Belly-nosing, i.e. up-and-down massage with the snout and the back of the nose on the belly and sides of other piglets.
   b) Sucking, i.e. a chewing, nibbling and sucking upon ears, tails and other parst of the body of littermates.

Within each hour of observation, the litter was observed in 60 periods of 1 minute. During each minute, behavioural activities performed by a piglet were recorded, but only once per activity, and the number of piglets awake was recorded.

The number of minutes in which a piglet was exibiting a given activity, was defined as pigminutes. The number of pigminutes obtained for a given activity was expressed proportional to the number of piglets awake in each minute during the hour of observation. In this way, a given activity could be compared between litters of different sizes, even when some of the piglets were asleep during the period of observation.

Statistical analyses

Cortisol concentrations in plasma were related to succession of capture, age and housing by analysis of variance. The homogeneity of the residual variation was tested by Bartlett's test (*Snedecor & Cochran* 1967). In cases of non-homogeneous residual variation, square root transformation was applied to achieve homogeneity. Groups of mean values found to differ significantly by analysis of variance were further analysed via sequential comparison (*Snedecor & Cochran*).

The behavioural activities were related to age and housing without differentiation between genetically unrelated litters.

The effect of age on behaviour was analysed for each of the housing conditions. For pair-wise comparisons between the 3rd and 4th, the 4th and 6th, the 6th and 8th and the 8th and 9th week of age, χ^2-test was used. Data used for the χ^2-test were total pigminutes for all litters with and without the particular behavioural activity among piglets awake.

The effect of housing on behaviour was analysed for each of the 2 following periods: 4th—8th, and 9th week of age. For pair-wise comparisons between control, cage 0.20 and cage 0.15 litters, Student's t-test was used on means of piglet activity, i.e. the number of pigminutes for the particular behavioural activity in percentage of the total number of pigminutes for littermates awake. In case of unequal variances, an approximation for degrees of freedom was used (*Hald* 1952).

Analysis of the possible association between plasma cortisol concentration and playing, aggressive, sucking and belly-nosing activity, respectively, was performed via the Spearman non-parametric rank correlation procedure with correction for ties

(*Siegel* 1956). The data were mean results of plasma cortisol concentrations (μg/l) for each individual piglet from the 3rd, 4th—8th and 9th week of age, respectively, and the number of pigminutes for each individual piglet performing each of the behavioural activities in percentage of the total number of pigminutes for littermates awake. Data from all piglets in Experiments II—IV were included.

RESULTS

Succession of capture in relation to plasma cortisol concentrations

For weaned piglets, the material was divided into 2 parts, early and late capture values, with low and high levels of plasma cortisol, respectively (Table 1). This was a consequence of a statistically highly significant association between the plasma cortisol concentration and the succession of capture (Table 1).

Table 1. Plasma cortisol concentration in relation to succession of capture of early weaned piglets, age interval 4th to 8th week, and of all piglets regardless housing at the 9th week of age.

Succession of capture	4th—8th week of age				9th week of age		
	cage 0.20		cage 0.15		control, cage 0.20 and cage 0.15		
	mean cortisol		mean cortisol		mean cortisol		
	μg/l	n	μg/l	n	μg/l	n	
1	14.3 a	20	17.7 a	27	12.1 a	11	
2	12.8 a	20	19.1 a	26	15.8 ab	11	
3 early	16.0 a	19	21 a	27	18.2 abc	10	
4	20 a	20	26 ab	27	22 abcd	10	
5	21 a	20	32 bc	27	33 ce	10	
6	28 b	19	36 bc	21	31 be	9	
7	32 b	7	36 bc	20	30 be	6	
8 late			35 bc	7	36 de	3	
9			42 c	7	40 e	2	
10					40 e	1	
F	8.8		11.1		9.3		
d.f.	6/78		8/180		9/63		
P	<0.001		<0.001		<0.001		
s.e.m.	2.27		2.78		4.07		

Means not differing significantly have letters in common.
Control, cage 0.20 and cage 0.15: See text.

In suckling piglets, early and late capture cortisol values discriminated piglets chased from 1 to 4 times and more than 4 times before capture (*Worsaae* 1980).

Plasma cortisol in relation to age and housing

Early capture values

The influence of age and housing on plasma cortisol concentrations was found to be different for the 4 genetically unrelated groups of litters in Experiments I—IV. However, to achieve an overall picture, results from the genetically unrelated litters were pooled, so that analysis could be performed both on results from Experiments I—III (control, cage 0.20 and cage 0.15) and I—IV (control and cage 0.15). However, for Experiments I—IV the residual variation was not homogenous, neither using cortisol concentrations ($P < 0.001$) nor square root transformed values ($P < 0.01$).

Both for Experiments I—III and I—IV, the association between square root transformed cortisol concentrations and age was highly significant ($P < 0.001$) (Tables 2 and 3). The plasma cortisol concentrations were lower at the 3rd week of age compared to any later stage regardless of housing (Tables 2 and 3).

Table 2. Early capture values of square root transformed plasma cortisol concentrations in relation to age and housing of piglets (Experiments I—III).

Source of variation		mean	n	P	s.e.m.
Weeks of age	3rd	2.9 (8.4) a	66	< 0.001	0.153
	4th	3.8 (14.4) b	101		
	6th	3.7 (13.7) b	76		
	8th	4.0 (16.0) b	76		
	9th	4.0 (16.0) b	34		
Housing	control	3.4 (11.6) x	103	< 0.05	0.112
	cage 0.20	3.7 (13.7) y	138		
	cage 0.15	3.8 (14.4) y	112		
Age × Housing				> 0.05	

Means not differing significantly have the same letter superscripts when compared for variations with age and housing, respectively. The corresponding cortisol concentrations (μg/l) are given in brackets.
Control, cage 0.20 and cage 0.15: See text.

Table 3. Early capture values of square root transformed plasma cortisol concentrations in relation to age and housing of piglets (Experiments I—IV).

Source of variation		mean	n	P	s.e.m.
Weeks of age	3rd	2.7 (7.3) a	63		
	4th	3.8 (14.4) b	85		
	6th	3.9 (15.2) b	62	<0.001	0.163
	8th	4.1 (16.8) b	62		
	9th	3.8 (14.4) b	30		
Housing	control	3.3 (10.9) x	147	<0.001	
	cage 0.15	4.0 (16.0) y	155		
Age × housing				>0.05	

Means not differing significantly have the same letter superscripts when compared for variations with age and housing, respectively. The corresponding cortisol concentrations (μg/l) are given in brackets. Control and cage 0.15: See text.

Both for Experiments I—III and I—IV, the association between square root transformed cortisol concentrations and housing was significant ($P < 0.05$ for Experiments I—III; $P < 0.001$ for Experiments I—IV).

The plasma cortisol concentrations were lower in control piglets compared to early weaned piglets (Tables 2 and 3).

Late capture values

As the influence of age and housing on plasma cortisol concentrations was the same for the 4 genetically unrelated groups of litters in Experiments I—IV, values from pigs of the same age and kept under identical housing conditions were pooled.

Since age and housing conditions interacted statistically significant ($P < 0.01$) in relation to the cortisol concentrations, it was necessary to perform separate analyses:

Age. For control piglets, the plasma cortisol concentrations increased from the 3rd to the 4th week of age, remained constant from the 4th to the 8th week of age and then increased further from the 8th to the 9th week of age, i.e. at weaning. Both for cage 0.20 and cage 0.15 piglets, the plasma cortisol concentrations increased from the 3rd to the 4th week of age, at weaning, remained constantly high from the 4th to the 8th week of age, when the piglets were in cages, and did not change from

the 8th to the 9th week of age, when the piglets were moved from cages to pens (Table 4).

H o u s i n g. Both during the 3rd week of age, when all piglets were suckling, and during the 9th week of age, when all littermates were in pens, no significant differences in plasma cortisol concentrations were found. During the 4th week of age, i.e. during the 1st week in cages for early weaned piglets, cage 0.15 piglets had the highest and control piglets had the lowest plasma cortisol concentrations. During the 6th week of age, i.e. the 3rd week in cages for early weaned piglets, cage 0.20 and cage 0.15 piglets had the highest plasma cortisol concentrations. During the 8th week of age, i.e. the 5th week in cages for early weaned piglets, cage 0.15 piglets had the highest plasma cortisol concentrations (Table 4).

T a b l e 4. Late capture values of square root transformed plasma cortisol concentrations (Experiments I—IV) in relation to age and housing.

Source of variation			Housing: control mean	n	cage 0.20 mean	n	cage 0.15 mean	n	P	s.e.m.
	Suckling period	3rd	3.4(11.6) x a	34	3.5(12.3) x a	15	4.0(16.0) x a	24	>0.05	
		4th	4.3(18.5) x b	38	5.2(27) y b	10	6.0(36) z b	34	<0.001	0.195
Weeks of age	Suckling/ cage period	6th	4.4(19.4) x b	26	5.5(30) y b	8	5.8(34) y b	24	<0.001	0.23
		8th	4.8(23) x b	24	5.4(29) x b	8	5.7(32) y b	24	<0.01	0.22
	Pen period	9th	5.9(35) x c	12	5.7(32) x b	7	5.4(29) x b	12	>0.05	
P			<0.001		<0.001		<0.001			
s.e.m.			0.188		0.34		0.185			

Means compared for age effect for each of the different housing conditions have letter superscripts a, b and c.
Means compared for effect of housing at each of the different age categories have letter superscripts x, y and z. Means not differing significantly in each of the comparisons have same letters.
The corresponding cortisol concentrations (μg/l) are given in brackets.
Control, cage 0.20 and cage 0.15: See text.

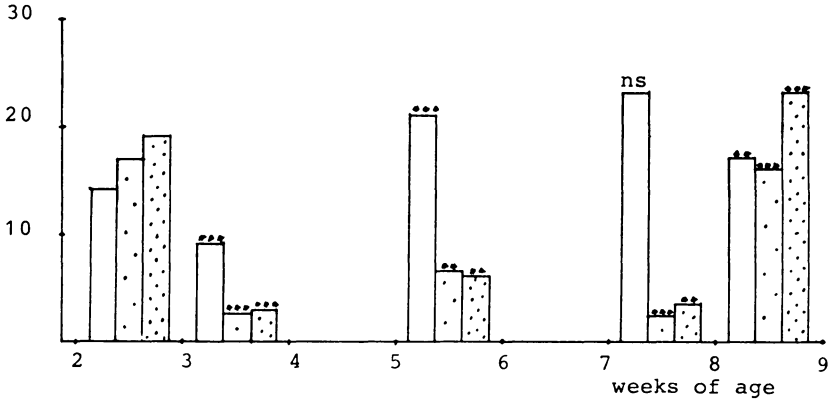
Behaviour in relation to age and housing

A g e

The behavioural activities during the 3rd, 4th, 6th, 8th and 9th week of age for each of the housing conditions are seen from Figs. 1a, 2a, 3a and 4a. Results of comparisons of data between the 3rd and 4th, the 4th and 6th, the 6th and 8th, and the 8th and 9th week of age may be seen from the figures.

a

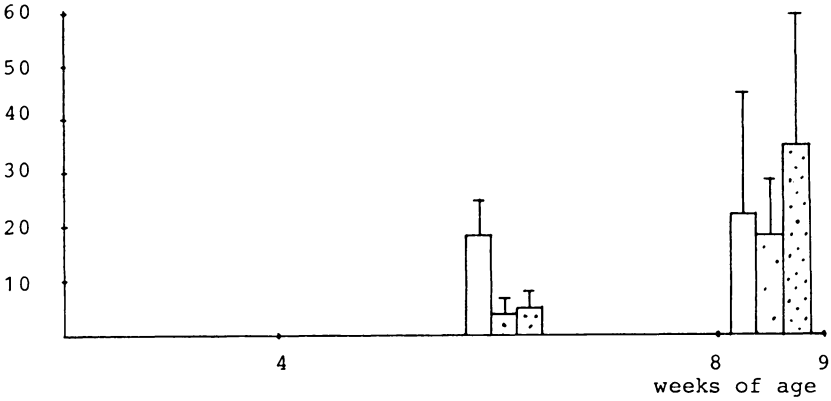
Sum of pigminutes in % of sum of pigminutes for piglets awake



**: $P < 0.01$; ***: $P < 0.001$, for significantly different values between 1 week interval and the preceding for each of the housing conditions. ns: no significant difference.

b

Mean + s of pigminutes in % of pigminutes for littermates awake



F i g u r e 1. Playing behaviour of piglets in relation to a) age and b) housing conditions.

□ = control; ▫ = cage 0.20; ▫ = cage 0.15.

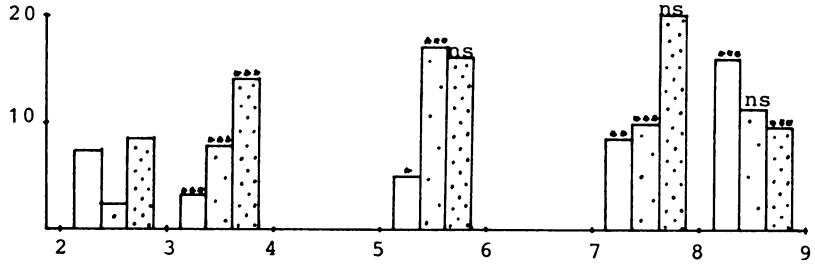
For definitions and calculations: See text.

Changes in playing and aggressive activity were seen during the 3rd—8th week of age for control piglets. The playing activity decreased, and the aggressive and sucking activity increased from the 8th to the 9th week of age, at weaning.

The playing activity decreased, and the aggressive and sucking activity increased from the 3rd to the 4th week of age, at early weaning, both for cage 0.20 and cage 0.15 piglets, whilst belly-nosing increased only for cage 0.15 piglets. The playing activity

a

Sum of pigminutes in % of sum of pigminutes for piglets awake



*: $P < 0.05$; **: $P < 0.01$; ***: $P < 0.001$, for significant different values between 1 week interval and the preceding for each of the housing conditions. ns: no significant difference.

b

Mean + s of pigminutes in % of pigminutes for littermates awake

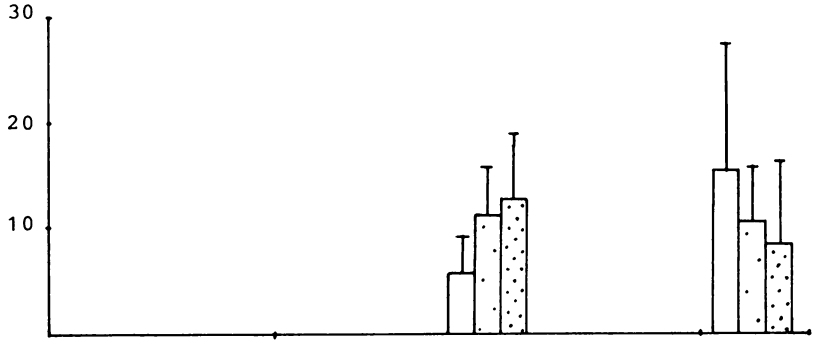


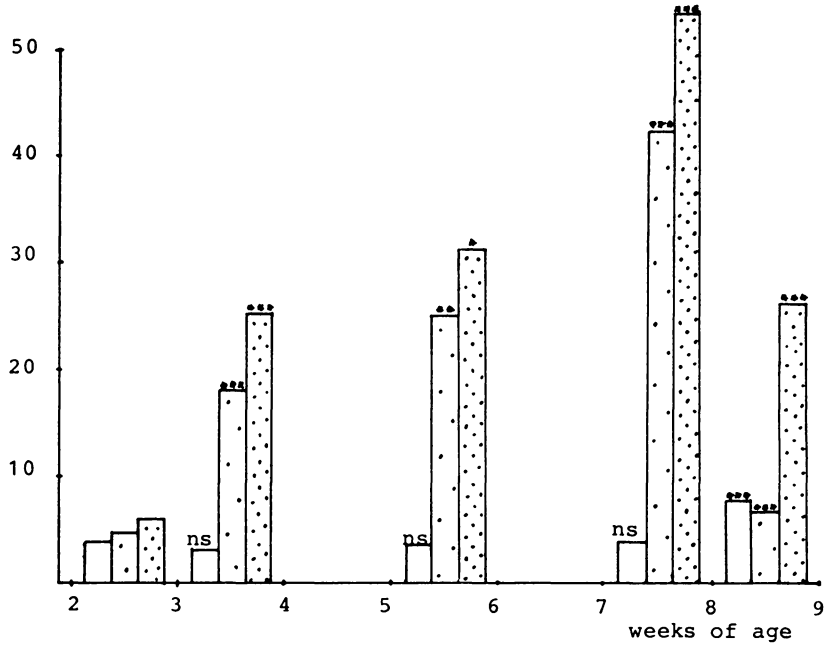
Figure 2. Aggressive behaviour of piglets in relation to a) age and b) housing conditions.

□ = control; ⊡ = cage 0.20; ⊡ = cage 0.15.

For definitions and calculations: See text.

a

Sum of pigminutes in % of sum of pigminutes for piglets awake



*: $P < 0.05$; **: $P < 0.01$; ***: $P < 0.001$, for significant different values between 1 week interval and the preceding for each of the housing conditions. ns: no significant difference.

b

Mean + s of pigminutes in % of pigminutes for littermates awake

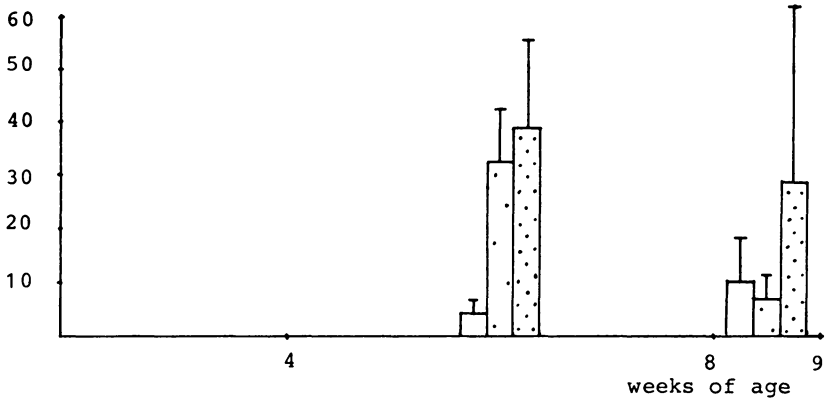


Figure 3. Sucking behaviour of piglets in relation to a) age and b) housing conditions.

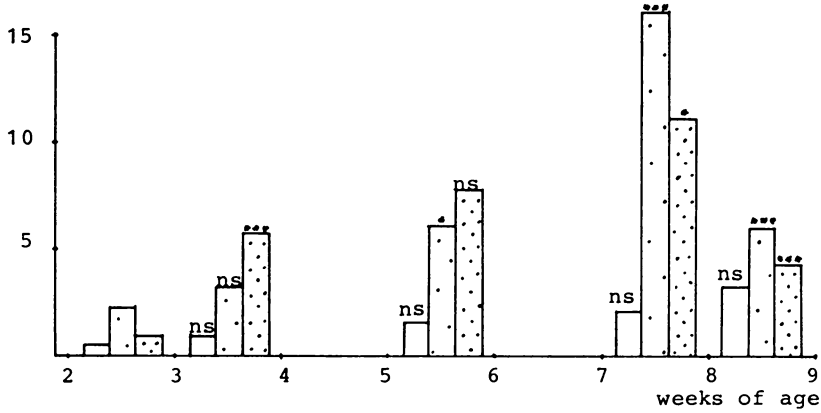
□ = control; ⊡ = cage 0.20; ⊡ = cage 0.15.

For definitions and calculations: See text.

increased and the sucking and belly-nosing activity decreased from the 8th to the 9th week of age, when the piglets were moved from cages to pens, both for cage 0.20 and cage 0.15 piglets, whilst aggressive activity decreased only for cage 0.15 piglets.

a

Sum of pigminutes in % of sum of pigminutes for piglets awake



*: $P < 0.05$; ***: $P < 0.001$, for significantly different values between 1 week interval and the preceding for each of the housing conditions. ns: no significant difference.

b

Mean + s of pigminutes in % of pigminutes for littermates awake

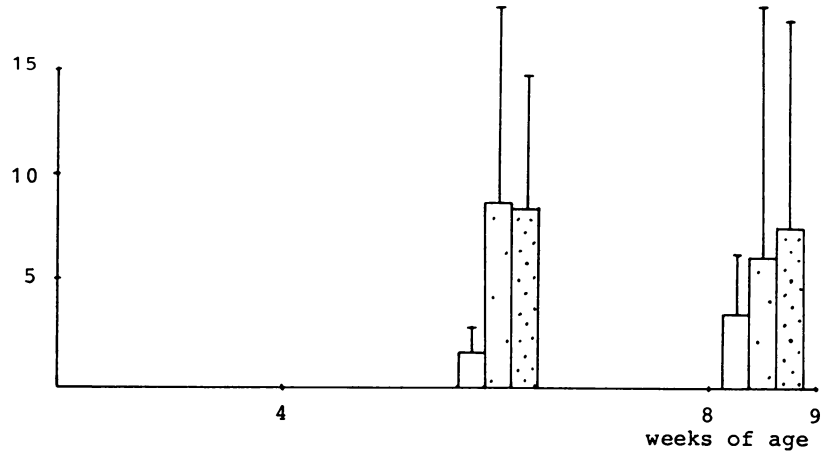


Figure 4. Belly-nosing of piglets in relation to a) age and b) housing conditions.

□ = control; ⊡ = cage 0.20; ⊡ = cage 0.15.

For definitions and calculations: See text.

Housing

The behavioural activities during the 4th—8th and 9th week of age for each of the housing conditions are seen from Figs. 1b, 2b, 3b and 4b. The material from Experiments II—IV included 24 control piglets, 13 cage 0.20 piglets and 21 cage 0.15 piglets. Significantly different values found as results of pair-wise comparisons between all the housing conditions during the 4th—8th week of age when early weaned piglets were in cages, and during the 9th week of age when all littermates were in pens, were for each of the behavioural patterns:

Playing. During the 4th—8th week of age, both cage 0.20 piglets (d.f. 31) and cage 0.15 piglets (d.f. 36) played significantly less ($P < 0.001$) than control piglets. During the 9th week of age, cage 0.15 piglets played significantly more ($P < 0.05$, d.f. 29) than cage 0.20 piglets.

Aggressive behaviour. During the 4th—8th week of age, the activity was significantly higher ($P < 0.001$) for both cage 0.20 piglets (d.f. 35) and cage 0.15 piglets (d.f. 30) than for control piglets. During the 9th week of age, the activity was significantly higher ($P < 0.05$, d.f. 39) for control piglets than for cage 0.15 piglets.

Sucking. During the 4th—8th week of age, the activity was significantly higher ($P < 0.001$) for both cage 0.20 piglets (d.f. 13) and cage 0.15 piglets (d.f. 21) than for control piglets. During the 9th week of age, the activity was significantly higher ($P < 0.05$) for cage 0.15 piglets than both for control piglets (d.f. 22) and cage 0.20 piglets (d.f. 21).

Belly-nosing. During the 4th—8th week of age, the activity was significantly higher for both cage 0.20 piglets ($P < 0.05$, d.f. 12) and cage 0.15 piglets ($P < 0.001$, d.f. 21) than for control piglets.

Association between plasma cortisol concentrations and behavioural activities

There was negative correlation between plasma cortisol concentrations and playing behaviour. There was positive correlation between plasma cortisol concentrations and each of the behavioural activities: aggressive and non-nutritive oral behaviour (Table 5).

Table 5. Association between plasma cortisol concentrations and scores for behavioural activities for individual piglets in the 3rd, 4th—8th and 9th week of age for all housing conditions (Experiments II—IV).

Association test	n	correlation coefficient r_s	t	P
Cortisol/playing	174	—0.210	2.7	<0.01
Cortisol/aggression		0.176	2.4	<0.02
Cortisol/sucking		0.212	2.9	<0.01
Cortisol/belly-nosing		0.262	3.6	<0.001

For explanation of data used: See text.

DISCUSSION

Short-term stressors lead to elevated plasma corticosteroid concentrations in pigs. This was shown by keeping the animals at 45°C for 15 min (*Lundström et al.* 1975), by exposing the animals to 40°C and 100 % relative humidity for 40 min (*Jedlicka et al.* 1976), by the escape avoidance conditioning, by exposure to 0°C for 1 h and by chasing the pigs in a small yard for 29 min with an electric goad (*Baldwin & Stephens* 1973), and by restraint of pigs for 8 h (*Weiss & Scherzinger* 1973).

The effect of long-term stress has been more contradictorily shown via exposure to fluctuating temperature/humidity over a 24 h period (*Aberle et al.* 1976) and different combinations of high and low temperature with high and low humidity lasting for about 1 week (*Marple et al.* 1972 a, b).

Weaning at the age of 40—47 days has been investigated as a form of prolonged stress in piglets. There was a somewhat higher concentration of plasma 17-OHCS 48 h after weaning (*Dvorák* 1972).

Weaning at 21 days of age resulted in an increase of the activity of certain enzymes in the adrenal gland or cranial cervical ganglia, enzymes which are associated with the adrenergic function. The effect persisted for at least 18 days. Some, although not significant, increase of adrenal cortisol level was seen when comparisons were made to non-weaned piglets, but tissue concentrations of hormones were considered a poor index of endocrine function (*Stanton & Mueller* 1976).

In this study, chasing at blood collection could be regarded as a short-term stressor; plasma cortisol concentrations increased with increasing number of chases before the piglets were caught.

For the early captured piglets with low levels of plasma cortisol, early weaning was supposed to be the dominating stressing factor and could be regarded as a long-term stressor. Plasma cortisol concentrations were higher in early weaned piglets, regardless of density in cages, than in non-weaned piglets. This difference was more profound when only high-density cage piglets were compared to control piglets. The increase occurred from the 3rd to the 4th week of age, i.e. weaning for the early weaned piglets, with no further changes.

For the late captured piglets with high levels of plasma cortisol, early weaning could be regarded as a long-term stressor with a superimposed short-term stressor, i.e. chasing. It could be expected that the degree of a stressful situation and the possibility of adaptation for the piglets would influence the degree of increase of plasma cortisol concentrations. This was confirmed by the fact that during the 1st week after early weaning, plasma cortisol concentrations were highest in high-density cage piglets and lowest in control piglets. During the 3rd week after early weaning, plasma cortisol concentrations were higher in early weaned piglets, regardless of density in cages, than in control piglets. Finally during the 5th week after weaning, high-density cage piglets had higher plasma cortisol concentrations than both low-density cage piglets and control piglets. The increase occurred from the 3rd to the 4th week of age, i.e. weaning for the early weaned piglets with no further changes until the 8th week of age. Besides, plasma cortisol concentrations increased from the 8th to the 9th week of age for control piglets, i.e. at "normal" weaning.

The results of the behavioural study are for a great deal in agreement with results obtained in other investigations (*van Putten & Dammers* 1976, *Marx* 1977, *Fraser* 1978).

An exception is the playing behaviour, and the main reason is the discrepancy in the difinition of this activity. Thus, *van Putten & Dammers* included aggressive fightings in their definition of play. They found no difference in the activity between early weaned piglets and control piglets. The definition by *Marx* included the biting in and sucking on cage and other liveless objects as play. He found an even higher frequency of play in early weaned piglets than in control piglets.

In the present study, early weaned piglets in cages played significantly less than non-weaned piglets. The deviation from the result of *van Putten & Dammers* can be explained by the fact that aggressive fightings increased by early weaning (in agreement with *Fraser*), thus counteracting with play in our definition. An explanation for the deviation between our results for playing behaviour and those of *Marx* could be that he included activities for play, which other investigators define as conflict behaviour. These activities increase by early weaning (*Schmidt* 1977 and *van Putten* 1978).

The early weaned piglets showed significantly more aggressive behaviour (in agreement with *Fraser*) and sucking and belly-nosing (in agreement with *van Putten & Dammers* 1976 and *Fraser*) than non-weaned piglets. The abnormal behaviour could be a sign of a lower level of well-being in the early weaned piglets (*van Putten & Dammers*). It could be a result of discomfort or fatique (*Fraser*) or of gastrointestinal dysfunction and anxiety (*Stanton & Mueller*).

The weaning per se is a stressor. This was emphasized by the fact that the control piglets during the 9th week of age, after normal weaning at 8 weeks of age, showed a decrease in playing behaviour and an increase in aggressive and sucking behaviour.

Relating to weaning as early as at 3 weeks of age and to keeping the piglets in cages with very few stimuli, it is tempting to suppose that the well-being of the piglets will be lowered, especially under extreme housing conditions. This was confirmed by the fact that after early weaning and when keeping the piglets in cages with high density, the playing behaviour decreased and aggression and non-nutritive oral activity increased, while the opposite was found after the piglets were removed from the cages. For piglets kept in low density cages the described picture was less pronounced.

The main conclusions of this study are that early weaning may be regarded as a stressor as indicated by an increase of plasma cortisol concentrations and certain behavioural modifications.

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SAMMENDRAG

Plasma cortisol og adfærd hos tidligt fravænnede grise.

I aldersintervallet 2—9 uger blev tidligt fravænnede grise og grise fravænnet i 8 ugers alderen sammenlignet, idet plasmacortisol og adfærdselementer blev anvendt som parametre. Til plasmacortisolbestemmelsen blev anvendt radioimmunoassay. Den adfærd, der blev registreret, var leg, aggression og non-nutritiv oral adfærd (sutten og trynepuffen).

De tidligt fravænnede grise blev fjernet fra soen 3 uger gamle. Hele kuld blev sat i bure med gulvareal på henholdsvis 0.20 m^2/gris og 0.15 m^2/gris.

Da de var 8 uger gamle blev kontrolgrisene fravænnet og burgrisene blev taget ud af burene. Alle kuld blev anbragt i stier med strøelse.

Statistisk analyse for eventuel sammenhæng mellem plasma cortisol og alder, opstaldningsforhold, kuld og den rækkefølge, i hvilken grisene blev fanget, viste et komplekst mønster. Generelt var tidlig fravænning associeret med højere plasma cortisolindhold og mere aggressiv og non-nutritiv oral adfærd, men med mindre legeadfærd. Plasma cortisol koncentration var hos de enkelte grise positivt korreleret med både aggressiv og non-nutritiv oral adfærd, men negativt korreleret med legeadfærd.

Det konkluderes, at tidlig fravænning er en stressor.

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