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'Kindergarten' keeping-system in farrowing house: effect the socialization of piglets on weight performances, fecal cortisol metabolite level and post-weaning behavior

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SUMMARY

This study aimed to examine whether litters' let-together system before weaning ('kindergarten-system') has any stress effect and effect on post-weaning behavior, respectively. One week before weaning piglets were socialized by removing four adjacent farrowing crate walls. After weaning, piglets from the same experimental groups were housed in the same rearing crates. The piglet's body weight was measured at birth than weekly till the 7th life-week. Fecal cortisol metabolites were measured for evaluation of the adrenocortical activity. Personal observation and evaluation were carried out for behavioral analyses after weaning. There were no significant differences in weight development and cortisol metabolite levels between the control and experimental groups. Behavioral analysis showed that pigs grow up in a socialized system, rapidly evolve ranking in the rearing crates, and the self-maintenance and social behavior were more pronounced. In control groups, the activity involving movement (exploring, walking, and running) was much more decisive. Recent work suggested the beneficial effect of the 'kindergarten' system in the farrowing house in animal welfare aspects.

Keywords: *fecal cortisol; weaning stress; animal welfare*

INTRODUCTION

Piglets in commercial intensive pig husbandry are often abruptly weaned between 3 and 4 weeks for economic reasons. In the European Union, weaning pigs before 28 d of age is normally prohibited (European Community Commission Directive, 2001). EU legislation does not allow weaning before piglets are 28 days old or 21 days when transferred to specialized disinfected pens separated from the sows (Kick et al., 2012; Oostindjer et al., 2014).

In free-ranging conditions, sows will generally seek out a secluded nest location a few days before farrowing, and then spend most of their time in the nest during the first few days post-partum. The sow and litter then rejoin the rest of the social group when the piglets reach 4–5 days of age. Thus under natural conditions, piglets may be predisposed to form social bonds with litter-mates immediately after birth, and with other piglets in the social group at 10–12 days of age (Meynhardt, 1986; Pitts et al., 2000). Individual play behavior and social play, which involves nudging or pushing other begins at 3–5 days of age and peak at 21–25 days (Blackshaw et al., 1997). Pigs do appear to be especially good at establishing dominance relationships at around 5–12 days of age through short fights, with a minimum of bullying (Jensen, 1994; Pitts et al., 2000).

Weaning age is one factor that affects how fast piglets adapt to the post-weaning situation. Many studies show early weaning age (e.g.7 or 14 days) is detrimental to performance and welfare (Oostindjer et al., 2014).

An enriched environment contributes to pig wellbeing in numerous ways, as indicated by increased behavioral diversity, adaptability to novelty, and learning ability, coupled with reduced aggression, fearfulness, stereotyped behavior, belly nosing, and tail and ear biting. The environmental enrichment should increase species-specific behavior; maintain or improve levels of health or improve the economics of the production system as well (van de Weerd and Day, 2009). Play behavior is a prominent part of the social interactions in piglets and can be considered as an indicator of welfare. Play is a cognitively demanding activity that results in reduced vigilance towards external threats and, therefore, should occur only under relatively safe conditions. The pre-weaning housing system may also prevent the negative side of the social interactions among piglets (namely, their agonistic behavior) and amplifies the positive social behavior: sniffing, nosing, licking and moving gently away from the pig without an aggressive or fight reaction from this individual (Zhou et al., 2013). However, agonistic behavior is important for the establishment of a dominance hierarchy among new group members (Chaloupková et al., 2007).

The process of weaning is a multifactorial stressor, in which nutritional, social, physical, and psychologic stressors are combined (Kick et al., 2012). Piglets are often exposed to unfamiliar piglets around weaning which results in a period of vigorous fighting (Oostindjer et al., 2014). Post-weaning aggression presents a significant cost to animal welfare and economic efficiency due to stress or injury. Although in commercial keeping systems individual litters are

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separated in farrowing crates, previous studies have suggested that housing systems that allow pre-weaning socialization of piglets can reduce aggression after weaning (Parratt et al., 2006, Salazar et al., 2018).

Stress plays an important part in welfare research. The corresponding defense reactions of an animal as "stress responses' include behavioral changes, changes to the immune system, and activation of the neuroendocrine system (hypothalamic-pituitary-adrenal /HPA/ axis) and the autonomous nervous system. Catecholamines and glucocorticoids (GCs) (secreted by the medulla and cortex of the adrenals, respectively) are released within seconds to minutes after the stressor. They are front-line hormones in the battle to overcome stressful situations (Palme et al., 2012). The detrimental consequences of the increase in free corticosteroid concentrations are either physiological, measured in terms of immunoreactivity or plasma glucose, urea or protein concentrations, or production-related measured in terms of growth rate, sexual behavior, or pregnancy rate. These detrimental consequences generally occur when increases in free corticosteroids of >40% occur (Barnett and Hemsworth, 1990). Both hormones are quickly metabolized and excreted via urine and faces. Traditionally GCs are measured in blood samples but their use is often limited as the act of sample collection may stress an animal. Fecal samples offer the advantage that they can be collected easily without stressing the animal, enabling repeated measurement in individuals (Palme et al., 2012).

Measurement of fecal cortisol/corticosterone metabolites (FCM) is a non-invasive method for the evaluation of the adrenocortical activity. However, there is a time delay between increased plasma GCs levels and their reflection in the excreted FCM (gut passage time from the duodenum to the rectum) (Palme et al., 1996).

This study aimed to examine the effect of litter's let-together-system ("kindergarten'-system) in the farrowing house before weaning on weight development and post-weaning behavior, respectively. We tested whether pigs socialized with non-littermates pre-weaning would show less aggression when they are housed in rearing crates and whether socialization influenced the time budgets or behavioral expression of piglets at weaning.

MATERIALS AND METHODS

Animals

A total of 295 piglets from 28 litters were examined (Large White x Landrace hybrids; primiparous vs. multiparous). Litter size at weaning was 10.8±1.6 (mean±S.D.). The sows were kept in groups during gestation and moved into the farrowing house (28 sows/unit) using crates with solid concrete floors, 3 or 4 days before the expected date of farrowing. Sows with piglets were kept under identical conditions in individual pens. The piglets are housed with their mother for 28 days (weaning). All piglets included in this study were born over three days. On day 2 postpartum, all piglets received industry-standard processing (tail docking, ear notching, iron injections, and castration of males).

There were 12 control litters and 4 experimental groups (4 experimental groups = 4x4 litters).

Experimental groups

Piglets from 16 (4x4) sows were socialized pre-weaning (n=178 piglets). Facilitation of socialization of piglets was carried out one week before weaning (19^{th}–21^{st} day postpartum) by removing 4 adjacent farrowing crate walls'. The sows stayed in their cradles, but the piglets could walk, move, and get to know each other for a week. We call it the 'kindergarten' system, as the piglets, can go back to their mother any time.

Control groups

For comparison litters from another 12 sows were monitored as control animals (n=117 piglets). The piglets stayed in their farrowing pen till weaning.

The arrangement of control and experimental groups see *Figure 1.*

Figure 1. **The arrangement of the control and experimental groups in the farrowing house after let together time**

<table>
<tr><td rowspan="3">socialised</td><td>control</td><td>control</td><td rowspan="3">socialised</td><td>control</td><td>control</td><td rowspan="3">socialised</td><td rowspan="3">socialised</td><td>control</td><td>control</td></tr>
<tr><td colspan="2">corridor</td><td colspan="2">corridor</td><td colspan="2">corridor</td></tr>
<tr><td>control</td><td>control</td><td>control</td><td>control</td><td>control</td><td>control</td></tr>
</table>

(1 socialized group = 4 litters).

Photo 1 shows the sows and piglets in the 'kindergarten system'.

After weaning the piglets from experimental groups were housed in the same rearing crates (4 groups to 4 different crates, n=46; 41; 48; 44 piglets/group). Piglets from control litters were mixed and grouped according to size and housed in 3 different rearing creates (n=39 piglets/group).

Bodyweight gain

Piglets were weighed (digital scales) within 24 h of birth, then weekly till 7^{th} life-week (3 weeks after weaning).

Average Daily Weight Gain (ADWG) was calculated from the data.

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Photo 1. **Sows and piglets in the 'kindergarten system'**

(Photo: Győri, Zs.)

Collection of feces

Fecal samples for monitoring stress hormone metabolites were collected:

- 3 times from sows (individual sample): at time of let together moment (0.h), and 8 and 24 hours after then;
- 6 times from litters and experimental groups (litter and group mixed sample): at time of let together moment (0.h), and 8 and 24 hours after then, and at weaning time (0.h), and 8 and 24 hours after, respectively

Fecal samples were dried to constant weight and stored frozen (-20 ºC) until assayed. For extraction 0.5 g feces sample was taken to a tube and 0.5 mL distilled water and 5 ml 80% methanol was added, respectively. After shaking (multi-vortex) and centrifugation (4 °C, 3000 speed/min, for 20 minutes) an aliquot of the supernatant was transferred to the immunoassay.

Cortisol assay

A direct radioimmunoassay method was developed by Abaváry, Nagy, and Kulcsár (1993) at the University of Veterinary Medicine, Department and Clinic of Reproduction, Endocrine-laboratory, Budapest for cortisol determination in plasma using 1,2,6,7-3H-cortisol (TRK 407; Radiochemical Centre, Amersham, UK) and a highly specific polyclonal antibody raised against cortisol-21-HS-BSA in rabbit (provided by V. Csernus, University Medical School, Pécs, Hungary; crossreactivity: cortisol: 100%; corticosterone: 19%; prednisolone: 9.5%; deoxycortisol: 6.4%; 17α-OH progesterone: 5.7%; progesterone: 2.6%; any other 22 steroids: 0.54- < 0.0001%). The assay standards (cortisol FW 362.5; Sigma Chemical Company, St.Louis, USA) were prepared in cortisol-free plasma (range: 2000 fmol to 31.25 fmol per tube). The antibody-bound and the free fractions were separated by cold dextran-coated charcoal suspension after an 18–24 hours incubation period. Radioactivity was measured by Beckman Instrument Typ LS 1701 liquid scintillation counter. The sensitivity of this assay system was 11.37 fmol/tube. Within the concentration range of about 2.00 and 100.00 nmol ml^{-1}, the intra- and interassay coefficients of variation varied between 3–8% and 5–10%, respectively in all species. Samples with cortisol levels higher than 100.00 nmol l^{-1} had to be re-assayed after dilution.

According to Barnett and Hamshworth (1990), it is reasonable to suggest a risk to welfare when a sustained elevation of > 40% in free corticosteroid concentrations (compared with control treatments) is evident. We determined the critical line of fecal cortisol metabolite level changing in ±30%.

Behavior analysis

Post-weaning observations

On the day of weaning, sows were removed and taken to dry-sow housing. Behavior of piglets was observed in nursery on weaning day and 2nd and 3rd day after introduction. Three types of self- maintenance behaviors (feeding, resting, sleeping), two types of investigating behaviors (exploring and walking-running), and one type of social behavior (playing) were recorded by using 2-min instantaneous scan sampling. The first observation started after transferring and housing to the nursery and lasted 6 hours. Then on 2nd and 3rd day from 0800 till 1100 a.m. and from 1400 till 1700 p.m., respectively. The same person performed all observations. The ethogram observed in this experiment is described in *Table 1*.

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Table 1. **Ethogram observed in this experiment**

Type of behavior	Description of behavior
Exploring	Investigation of the pen: sniffing, nosing, licking, or chewing all features of the pen. Investigation towards straw or other enrichment material (WQ®, 2009). Pig makes contact with floor substrate and makes repetitive nosing movements with snout (Rutherford et al., 2012). Instances of chewing, nosing, and exploring the pen or pen mates (Morgan et al, 2014).
Playing	Activity that started by hop, scamper, pivot, paw, flop and head toss (Donaldson et al., 2002), alone or in combination while running or standing. May later involve chasing without any biting. Performed solo or together with the other piglets from the group/litter (Silerove et al, 2010). Running across the pen, jumping, or shaking of the head with other piglets (Nakamura et al., 2011)
Feeding	Eating feed from the trough (Nakamura et al, 2011)
Walking-running	Walking between points in space (Nakamura et al, 2011). Running was recorded as a rapid movement in one direction and if the piglet changed direction this was a second run (Blackshaw et al., 1997)
Resting	Resting with sternum lying or lateral-lying (Nakamura et al, 2011). Laying with eyes open, without performing any other described behavior (Bolhuis et al, 2005).
Sleeping	Lying on the side or belly with eyes closed (Bolhuis et al, 2005) and breathing.

Statistical analyses

Weight measurement

Data were analyzed using repeated measure mixed effect models in the R program. Multiple comparison tests were done with Duncan's new multiple range test. To account for the repeated measures per piglet (across time: period), the individual was nested within treatments (sex, keeping-system) and treated as a random effect in the analysis. The model included fixed effects of treatments, time, and treatment×time. For all analyses, significance was considered to be $P<0.05$.

Cortisol metabolites: a comparative analysis

Physiologically the cortisol level varies greatly individually. The relative standard deviation was high (e.g. the measured values of sows were between 2.72 and 30.62 ng g^{-1} at the zero time). Therefore the evaluation of the data was carried out, that the sample was taken in firs time (0.h) was the basic value (100%), the increase or decrease in the percentage of 8th and 24th sample was compared to zero time. The crucial point was ±30% in variation; this difference was considered significant.

Behavior analysis

A repeated measures analysis was used for the analysis of play behavior. A Pearson's Chi-square test was used to investigate the association between the different behavior types and experimental groups.

Each behavior is expressed as the proportion of total observations per group per day. $P<0.05$ is used as the standard of the tendency of statistical difference.

RESULTS AND DISCUSSION

Weight performances

Table 1 shows the average weight and average daily weight gain (ADWG) of the control and experimental piglets (barrows and females, respectively) from birth till the 7th week of life.

Table 1. **The average weight and average daily weight gain (ADWG) of the control and experimental piglets from birth till the 7th week of life**

	Control				'Kindergarten'			
	barrow (n=49)		female (n=68)		barrow (n=89)		female (n=89)	
	average weight (kg)	ADWG (kg day^{-1})	average weight (kg)	ADWG (kg day^{-1})	average weight (kg)	ADWG (kg day^{-1})	average weight (kg)	ADWG (kg day^{-1})
Birth	1.55±0.3	–	1.51±0.3	–	1.53±0.3	–	1.52±0.3	–
1st week	2.38±0.7	0.13	2.41±0.7	0.13	2.60±0.9	0.15	2.63±0.8	0.15
2nd week	4.11±1.0	0.22	4.01±1.2	0.22	4.15±1.3	0.22	4.20±1.1	0.22
3rd week*	5.81±1.4	0.25	5.77±1.6	0.25	5.67±1.7	0.21	5.74±1.5	0.22
4th week**	7.49±1.7	0.24	7.46±1.9	0.24	7.33±2.1	0.23	7.39±1.8	0.23
5th week	8.37±1.9	0.12	8.32±2.0	0.12	8.15±2.2	0.11	8.43±1.9	0.14
6th week	10.21±2.3	0.26	10.17±2.4	0.26	9.98±2.6	0.26	10.35±2.2	0.27
7th week	12.76±2.9	0.36	12.74±3.1	0.36	12.51±3.1	0.36	12.88±2.7	0.36

*: start of the kindergarten system **: weaning

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There were no significant differences in body weight of socialized pigs compared to control pigs neither at birth nor at weaning nor three weeks after weaning.

The female's average weight in the experimental group on the 7th week was slightly higher than others (12.88 vs. 12.51, 12.74, and 12.76 kg). The experimental females' group were a bit homogeneous in weight than others (SD±2.72 vs. ±3.13, ±2.9, and ±3.09 kg, respectively). The average daily weight gain (ADWG) increased till the 4th week in every group and a significant decline was observed after weaning on the 5th week (0.23–0.24 vs. 0.11–0.14 kg/day). At the end of the 7th week, the ADWG was 0.36 kg/day in every group.

Fecal cortisol-metabolite (FCM) level

Sows FCM level at the let-together time

Ten samples of control sows' (from 12) and 11 of experimental sows' (from 16) cortisol assays were appraisable, because of measurement error.

Three from experimental sows' FCM value increased significantly 8 hours after the formation of the 'kindergarten'-system (+113, +164, and +178%, respectively), then reduced around the set point at the 24th hour. These increases have no importance in terms of the experiment since too short time had passed after forming the kindergarten groups (0 times) to make this show subsequent results in the feces.

Accordingly, the FCM level measured 24 hours after the formation of the 'kindergarten'-system decreased significantly 7 of control sows and 7 of experimental sows, as well (34 to 84%, respectively).

From the 21 examined animals 6 sows values did not change significantly (±30%) in the experimental period.

Piglets FCM level at the let-together time

The FCM level of the piglet groups was examined from a cage-mixed fecal sample at a let-together time. In 12 control-piglet groups (where there were no disturbing or changes) the FCM level showed a declining or unchanging trend compared to the initial value, 4 litters had more than 30% higher compared to the zero time.

In the case of 4 experimental groups, the measurement did not show a significant change in FCM level between 0–24 hours after the formation of "kindergarten' groups. One group elevated the cortisol metabolite level in the 8th hour to 236%, but after 24 hours returned to the level of 0 times.

Consequently, there were no significant differences in FCM level changing of control and experimental sows and piglets, respectively. Therefore based on measuring fecal cortisol metabolites the "kindergarten' system has no stress effect neither the sows nor the piglets, as well.

Piglets FCM level at weaning

Our prediction at the outset of this study was that piglets from the control group will be stressed because of mixing, but despite our assumption in most control groups FCM level decreased more than 30% in the 8th and 24th hours after weaning. Nonetheless in the second and third experimental groups – piglets from the 'kindergarten' system – FCM level increased by +88 and +143% respectively from zero time. However, the behavior of piglets from experimental groups was most calm (see below) than piglets from non-socialized litters.

Behavior

In our study in a large scale farm-system, 41–48 piglets were socialized one-week pre-weaning.

The sows stayed in their cradle, but the piglets could move and get to know each other. We call it the 'kindergarten' system because the piglets could walk away from their mothers, but as they felt danger immediately returned to their dam. Four weeks post-partum, piglets were weaned. The piglets from socialized groups - regardless of body size- had been moved to the same rearing cradle after weaning. There were 4 experimental ('kindergarten') and 3 control groups in the nursery, where the observations lasted 6 hours every day till 3 days after weaning. The observer recorded different types of behavior in the kindergarten and in control groups, as well. The percentage of different behavior types in the nursery see in *Table 2*.

Table 2. **Proportion of different behavior types in the first three day in nursery (%)**

Type of behavior	1st Day		2nd Day		3rd Day	
	kindergarten (n=1218)	control (n=961)	kindergarten (n=2387)	control (n=1228)	kindergarten (n=1968)	control (n=1520)
Exploring	**23.1***	16.3	9.5	**17.9***	**20.0***	14.4
Playing	0.0	**9.1***	**11.4***	3.3	**7.0***	4.9
Walking - running	5.8	7.6	4.1	**16.6***	2.6	**11.7***
Laying	18.3	19.5	**17.1***	13.0	**17.2***	11.8
Sleeping	**26.8***	22.6	44.6	18.5	**34.1***	27.6
Feeding	25.9	25.0	13.4	**30.7***	19.2	**29.6***
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**

n: number of observations *: significant differences between the different behavior types by groups and by days, P<0.05,

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On the first day in the nursery, the piglets from 'kindergarten' groups were more exploring and slept more. Interestingly, the registered playing behavior was 0% in kindergarten groups, they spent more time with exploring (23.1%) than control (16.3%). On the next two days the piglets from experimental groups played more (11.4 and 7.0%) than the control ones (3.3 and 4.9%).

On the 2nd day, the piglets from the 'kindergarten' groups were calmer, they spent 86.5% of time with laying, sleeping, feeding, and playing and only 13.6% with activity involving movement (exploring, walking-running). Meanwhile, this ratio in control groups was 65.5% (laying, sleeping, feeding, and playing) and 34.5% (exploring, walking-running), respectively.

On the 3rd day, the walking-running behavior was 11.7% in control groups, however in 'kindergarten' groups only 2.6%.

CONCLUSIONS

Aggression between group-housed pigs in commercial pig husbandry has been a long-standing animal welfare issue. Agonistic behavior occurs when unacquainted pigs are mixed. In commercial husbandry, pigs are regrouped several times during the production cycle which leads to intense fights. Fighting often results in the accumulation of skin lesions caused reduced growth and a suppressed immune response and have detrimental effects on the welfare and longevity of the animals (Stukenborg et al., 2012). Pigs that showed aggression at regrouping were heavier than their pen mates and had a higher weight gain (Algers, 1990).

Early socialization is, however not a common practice in pig husbandry. According to a US survey in 2015, the majority of respondents (pig farmers) did not perceive aggression between unfamiliar pigs as a problem that needed to be addressed. Society, however, generally perceives animal welfare as more problematic than farmers, and farmers in turn may differ in their perception about animal welfare when compared to scientists (Camerlink and Turner, 2017).

In our experiment one week before weaning piglets were socialized by removing 4 adjacent farrowing crate walls. We call it the 'kindergarten' system because the piglets could walk away from their mothers, but as they felt danger immediately returned to their dam.

In the last few decades, different methods for the overall assessment of animal welfare have been proposed and published. However, the assessment of animal well-being is a complex matter, parameters were found to which good and bad levels were assigned according to expert opinion. Weights were attributed to these parameters (Czycholl et al., 2015).

In our experiment, we examined the stress effect of socializing piglets before and after weaning by measuring weight and fecal cortisol- metabolite level and observation the behavior, respectively. Piglets were socialized 5–7 days before weaning, weaning occurred on the 4th week post-partum. Body weight was measured weekly, from birth till the 7th week of age. According to Algers (1990) piglets having had the largest weight gain between 3 and 4 weeks post-partum. In our study, the examined group's values were the same in that period. In a study by Morgan et al. (2014), there was no difference in the bodyweight of socialized pigs compared to control pigs at weaning or one week after weaning. Performing additional measurements we found no significant differences in body weight of socialized pigs compared to control pigs neither at birth nor at weaning nor three weeks after weaning. The female's average weight in the experimental group on the 7th week was slightly higher than others and they were a bit homogeneous in weight than others. The average daily weight gain (ADWG) increased till the 4th week in every group. A significant decline was observed in gain one week after weaning, but on the 6th week, the ADWG increased again. On the 7th week, the value of daily weight gain corresponded to the average value of the farm and was just the same in every examined group. Since there were no significant differences in weight development between control and experimental groups, respectively, we can assert, the "kindergarten' system has no negative effect on weight gain.

As activation of stress responses is context-dependent, moreover, the ability of the individual to cope with stress is different; measurement of a single parameter alone may be misleading. Thus, it is a common consensus that a combination of different measurements (e.g. physiological and behavioral) for evaluating stress should be considered. The non-invasive techniques for monitoring glucocorticoid metabolites in fecal samples are a useful tool for welfare assessment in various species, especially as they are easily applied at the farm or group level. Inter-disciplinary approaches using such methods can advance our understanding of the biology of stress and related animal well-being (Palme et al., 2012).

We examined the fecal cortisol metabolite level of sows and piglets after grouping and after weaning. There were no significant differences in cortisol metabolite levels between the control and the experimental groups of sows and piglets, as well. This confirms the above assertion that the 'kindergarten' system has no negative stress-effect.

Play behavior is considered a welfare indicator, i.e., a behavior documenting that the animal fares well and feels well. This is because play occurs only in physically and environmentally safe conditions (Siviy et al., 2006). The recent transition to group housing during gestation in the EU may result in a renewed interest in multi-suckling (MS) systems, for instance, in which sows are grouped with their litters. In the experiment of van Nieuwamerongen et al. (2014) multi-suckling piglets played 2.6 times more often and showed 2.4 times less manipulative behavior than piglets in farrowing crates (FC). The MS system promoted piglet play behavior and reduced harmful manipulative behavior, compared with FC housing, likely due to the physically and socially enriched and more spacious environment. The reduced manipulative

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behavior may decrease the risk of tail and ear biting problems in later life.

One of the goals of environmental enrichment programs is to increase the animal's ability to cope with behavioral and physiological challenges such as environmental variation (Manning and Dawson, 2012). Housing systems that allow the socialization of piglets pre-weaning can reduce aggression after weaning (Morgan et al., 2014). The socialization of piglets in the farrowing house is a kind of environmental enrichment, namely social enrichment involves direct contact with conspecifics. Allowing piglets to co-mingle approximately 2 weeks before weaning has been shown to reduce fighting in the post-weaning period. According to Parratt et al. (2006) allowing piglets to co-mingle at 5 days, pre-weaning did not affect growth rates in either the pre-weaning or post-weaning periods and mixed piglets showed significantly reduced fighting in the immediate post-weaning period than the controls. The pre-weaning housing system did not affect the frequency of agonistic behavior (Chaloupková, 2007).

According to Silerova et al. (2010) piglets from sow group housing systems, where several litters and sows lived together, are better prepared for weaning than those from individual housing of sows with litters because of increased freedom of movement and social contact as well as co-mingling litters before weaning affected piglet social behavior positively.

Play is fundamental to successful socio-cognitive development (Martin et al., 2015). Interestingly, in our experiment the registered playing behavior was 0% in 'kindergarten' groups on the first day in the nursery, they spent more time exploring than piglets from the control groups. After that (on the 2nd and 3rd day), the playing behavior took 2–3 fold time of piglets from 'kindergarten' group, then from non-socialized ones. Probably, as they already knew each other, and could play before weaning, it was a more exciting pastime to discover the new place.

Piglets from the 'kindergarten' groups spent more time laying, sleeping feeding, and playing and less time exploring, walking, and running.

In our experiment piglets were socialized by removing four adjacent farrowing crate walls where the sows stayed in the cradle. This technological solution is easy to implement even in a large-scale farming system. Behavioral analysis showed that pigs grow up in a socialized system, rapidly evolve ranking in the rearing crates, and the self-maintenance and social behavior were more pronounced. Piglets from the 'kindergarten' groups were calmer and spent less time with activities involving movement than the control ones. Piglet's behavior was significantly different, therefore it is thought to mean a difference in the welfare level of animals. Recent work suggested the beneficial effect of the 'kindergarten' system in the farrowing house in animal welfare aspects.

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