

VETERINARSKI ARHIV 83 (3), 333-339, 2013

The effect of environmental enrichment objects on weight gain in weaned pigs

Gordana Gregurić Gračner^{1*}, Ninoslav Šemiga², Mario Ostović¹, Anamaria Ekert Kabalin³, Kristina Matković¹, and Željko Pavičić¹

¹Department of Animal Hygiene, Behaviour and Welfare, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

²Stočar Pig-Breeding Farm, Ltd., Varaždin, Croatia

³Department of Animal Husbandry, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

GREGURIĆ GRAČNER, G., N. ŠEMIGA, M. OSTOVIĆ, A. EKERT KABALIN, K. MATKOVIĆ, Ž. PAVIČIĆ: The effect of environmental enrichment objects on weight gain in weaned pigs. Vet. arhiv 83, 333-339, 2013.

ABSTRACT

The aim of the study was to assess the effect of environmental enrichment objects on weight gain in weaned pigs. The study was carried out at two identical pig breeding farm weaner units during 60-day weaning period and included a total of 208 Topigs hybrid weaned pigs. The weaners were assigned to one of 5 treatments, i.e. control (n = 52) and 4 experimental treatments enriched with a car tyre on the floor, a hanging ball, a ball on the floor and a hanging chain, respectively (n = 39 each). The weaner body mass was determined on days 0, 30 and 60 post-weaning. Study results showed the weight gain to be significantly greater (P<0.05) in the experimental group with their environment enriched with a tyre as compared with either group with ball enrichment in the first half of the weaning period. During the same period, a significantly higher weight gain (P<0.05) was also recorded in the experimental group with their environment enriched with a hanging chain, as compared with the group enriched with a ball on the floor. Weight gain in the second half of the weaning period and total weight gain recorded from day 0 to day 60 was significantly lower (P<0.05) in the control group as well as in the groups enriched with a tyre or chain, as compared with both groups enriched with a ball. Accordingly, the effect of environmental enrichment with particular objects on weight gain in weaners depends on weaner age and type of objects, whereby ball as an enrichment object may prove effective in weight gain improvement.

Key words: pigs, weight gain, environmental enrichment, animal welfare

*Corresponding author:

Gordana Gregurić Gračner, DVM, PhD, Department of Animal Hygiene, Behaviour and Welfare, Faculty of Veterinary Medicine, University of Zagreb, 10000 Zagreb, Heinzelova 55, Croatia, Phone: +385 1 2390 293; Fax: +385 1 2441 390; E-mail: ggracner@vef.hr

ISSN 0372-5480
Printed in Croatia

Introduction

All physiological functions of animals greatly depend on their adaptability to environmental physical, chemical and biological factors (VUČEMILO et al., 2006). In their natural habitat, wild boars live in organized groups, consisting of a number of related females and their litters, whereas adult males live alone. They spend 75% of their active time in foraging-related behaviours (D'EATH and TURNER, 2010), travelling 7 km over a range of approximately 100 ha daily (LEMEL et al., 2003). In intensive production systems, however, pigs are bred individually or in groups of animals of similar ages and weights, in restricted and barren housing conditions. Such breeding conditions may result in the occurrence of behavioural abnormalities, with a potential threat to animal welfare (PUPPE et al., 2008).

In recent decades, legal regulations on these issues for the protection of farm animal welfare, have been enacted in the European Union as well as in Croatia. According to the Council Directive 2008/120/EC and the Ordinance laying down minimum standards for the protection of pigs in Croatia (Official Journal 119/10), one of these regulations refers to enrichment of the farm pig environment, including alternative enriched systems, straw-based systems, or barren production systems enriched only with objects (VAN DE WEERD and DAY, 2009).

Environmental enrichment may be defined as the enhancement in the biological functioning of captive animals resulting from modifications to their barren environment (NEWBERRY, 1995). It should improve animal welfare by increasing the number and range of normal behaviours and preventing the development of abnormal behaviours or reducing their frequency or severity. Also, it should increase positive utilisation of the environment and the animal's ability to cope with physiological and behavioural challenges (ANONYM., 2010).

Weaning is a stressful experience for piglets, considering the abrupt separation from the sow, changes in feeding (from milk to crude feed) and environment, i.e. mixing with unfamiliar piglets from other litters. In this period, piglets are more susceptible to diseases because of their immature digestive and immune functions, while regrouping additionally results in aggressive behaviour to establish dominance relationships (ANONYM., 2005). All this leads to reduced post-weaning growth rates (D'EATH and TURNER, 2010).

The effect of environmental enrichment objects on the growth of weaned pigs, in terms of reduced aggression among piglets, has been investigated in several studies. WARAN and BROOM (1993) found an improvement in growth rates of the piglets during the first week after weaning, characterized by most intensive aggression, when they were provided with an opaque barrier to hide behind. Overall, a lower proportion of time spent belly nosing and higher weight gain in early-weaned piglets assigned to treatment enriched with a hanging rope and rubber tyre tube, was also recorded by RODARTE et al. (2004). However, growth rates were not influenced by exposing the weaners to a fixed or free

metal out-dated sow neck tether covered with plastic piping on the floor (BLACKSHAW et al., 1997). In addition, WOOD et al. (2003) report improved weight gain in weaners with the use of enrichment objects, however, they failed to confirm these results in a second trial.

As the results on the effect of enrichment objects on the growth of weaners are not consistent, the present study could be perceived as a contribution to their elucidation.

Materials and methods

The present study was carried out on a commercial pig-breeding farm in winter, over 60 days, covering the weaning period. The study included a total of 208 Topigs hybrid weaned pigs accommodated in two identical environmentally controlled weaner units 1 and 2. Each unit has 8 pens, length 2.5 m, width 2.4 m and height 1.0 m, with a plastic slatted floor. Thirteen animals, 7 male castrated and 6 female piglets, were accommodated per pen. Respecting the production technology and farm conditions, the piglets were distributed into the pens randomly, taking care to form the groups of piglets mostly originated from the same litter.

The animals were assigned to one of 5 treatments, as follows: a barren control (C) (n = 2 pens in each weaner unit) and 4 enriched experimental groups. The groups enriched with a car tyre placed on the pen floor (E1) and hanging ball fixed to the ceiling by a chain (E2) were accommodated in unit 1 (n = 3 pens each enriched group). The groups with a free ball on the floor (E3) and a hanging chain fixed to the ceiling (E4) were accommodated in unit 2 (n = 3 pens each enriched group). A commercially available ball made from hard plastic, 30 cm in diameter (Schippers Canada, Ltd.) was used in both ball treatments. Hanging objects were suspended in the centre of the pen at the pigs' head level. One E2 and one E4 treated piglet died in the second half of the weaning period and were excluded from analysis. In both piglets the cause of death was gastrointestinal disease.

The mean ambient temperature and airflow velocity in both weaner units were 23.9 °C and 0.1 m/s, respectively, with daylight and additional artificial light from 6.00 a.m. to 2.00 p.m.; the mean relative humidity was 65.9% in unit 1 and 66.1% in unit 2.

The piglets had access to feed and water *ad libitum*. Pelleted prestarter (19.5% crude protein, 4% crude fat, 4.2% crude fibre and 17.8 MJ/kg of metabolic energy) was used in the first ten days, then gradually, over four days, switched to a diet with powdered starter (19% crude protein, 3.6% crude fat, 4.4% crude fibre and 13.3 MJ/kg of metabolic energy) until the end of the weaning period.

Piglet body mass was measured on a digital scale, maximal bearing capacity 100 kg, on three occasions: on their entry into the unit pens (day 0), on day 30 of their stay in the weaner unit, and on moving out from the unit (day 60).

Statistical data processing was done by Statistica v. 9 (StatSoft Inc.) reference software. The usual procedures of descriptive statistics were employed for basic data

processing. The significance of differences in weight gain between the groups of weaners recorded during the weaning period was analyzed by one-way analysis of variance (one-way ANOVA with unequal N HSD test for post-hoc analysis).

Results

The results of the effect of environmental enrichment objects on weight gain in weaned pigs, according to type of treatment and the stage of the weaning period are shown in Table 1. Average initial, intermediate and final piglet body weights are presented in Figure 1.

Table 1. Weight gain in weaners provided with different enrichment objects

Weaning period (days)	Weight gain (kg) (mean ± SD)				
	C group	E1 group	E2 group	E3 group	E4 group
0-30	9.19 ± 1.84 (n = 52)	9.70 ^{ab} ± 0.56 (n = 39)	8.84 ^a ± 0.53 (n = 39)	8.66 ^{bc} ± 0.79 (n = 39)	9.34 ^c ± 0.57 (n = 39)
30-60	13.50 ^{ab} ± 4.05 (n = 52)	13.51 ^{cd} ± 1.30 (n = 39)	16.01 ^{ace} ± 2.44 (n = 38)	16.61 ^{bdf} ± 1.46 (n = 39)	12.82 ^{ef} ± 1.62 (n = 38)
Total 0-60	22.69 ^{ab} ± 3.24 (n = 52)	23.21 ^{cd} ± 1.67 (n = 39)	24.85 ^{ace} ± 2.15 (n = 38)	25.27 ^{bdf} ± 1.94 (n = 39)	22.16 ^{ef} ± 1.40 (n = 38)

C group = control; E1 group = car tyre on the floor; E2 group = hanging ball; E3 group = ball on the floor; E4 group = hanging chain; a,b,c,d,e,f Values in the same row marked with the same letter in superscript statistically significantly different at the level of P<0.05

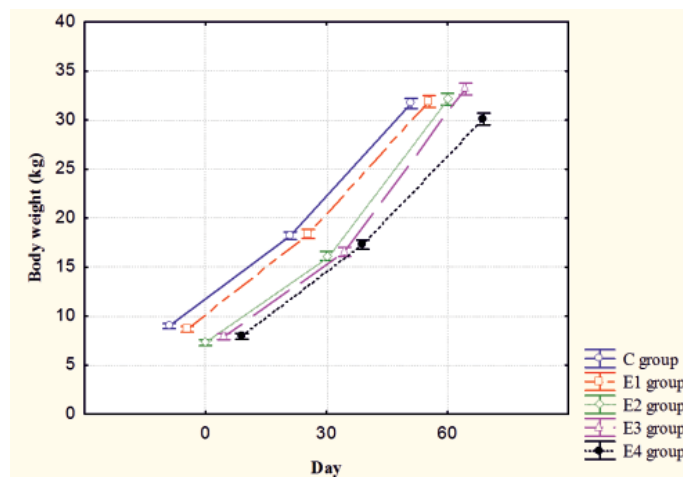


Fig. 1. Mean starting, intermediate and finishing piglet body weights during the weaning period

In the first half of the weaning period (day 0 to day 30), the mean weight gain was significantly greater in group E1 compared with groups E2 and E3, and in group E4 compared with group E3 ($P < 0.05$ both). The mean weight gain in the second half of the weaning period (day 30 to day 60) and the mean overall weight gain (day 0 to day 60) were significantly lower in groups C, E1 and E4 as compared with groups E2 and E3 ($P < 0.05$ all).

Discussion

Besides genetic predisposition, diet and exposure to pathogens, environmental conditions also influence weight gain in weaned pigs (DE GRAU et al., 2005). The aim of the present study was to investigate whether and to what extent environmental enrichment with various objects could influence weight gain in weaned pigs.

The study results clearly indicated treatment related differences in the weaned pig weight gain recorded in the first and second half of the weaning period, as well as the overall weight gain (Table 1). Differences in piglet response to particular enrichment objects within the same stage of the weaning period could be ascribed to object variations (VAN DE WEERD and DAY, 2009), whereas differences in weight gain among the piglet groups at different stages of the weaning period could be explained by the piglets preferring some objects over others (DOCKING et al., 2008), while their interest in some objects gradually declined with increasing age. Thus, animals are exposed to a non-enriched environment if the enrichment object fails to capture their attention for a long time (VAN DE WEERD and DAY, 2009).

A high rate of penmate-directed behaviour, which may be present in a non-enriched environment, exerts an unfavourable effect on pig productivity due to the impaired feeding pattern (RUITERKAMP, 1987). NOWICKI et al. (2007a, 2007b) found that pen enrichment with a ball reduced aggression in weaned pigs. This report could be related to the results of our study, since the highest total weight gain was recorded in groups E2 and E3. Despite the fact that, unlike hanging objects, those placed on the floor are contaminated with faeces, thus being less attractive to pigs (BLACKSHAW et al., 1997), the greatest total weight gain was recorded in group E3. In comparison with groups E2 and E3, a significantly lower total weight gain was recorded in group C, as well as in groups E1 and E4 (Table 1), which is consistent with the findings reported by PEARCE et al. (1989). In their study, these authors found no weight gain improvement in pigs accommodated in an environment enriched with bars, chains and tyres.

Due to the fact that the study was conducted in commercial breeding conditions and that piglets were randomly distributed in pens, their body weight varied (Fig. 1). However, in Fig. 1 it is noticeable, that despite the lower initial and intermediate body weight, final weight of piglets provided with a hanging ball, as well as the ball on the floor, was higher when compared with the other investigated groups, which additionally indicates the positive features of a ball as environmental enrichment.

In conclusion, the effect of environmental enrichment with various objects on weaned pig weight gain depends on their age and type of enrichment objects. Balls as environmental enrichment objects may have a favourable effect on weight gain in weaners.

References

- ANONYMOUS (2005): Opinion of the Scientific Panel on Animal Health and Welfare on a request from the Commission related to welfare of weaners and rearing pigs: effects of different space allowances and floor types. *EFSA Journal* 268, 1-19.
- ANONYMOUS (2010): Guide for the Care and Use of Agricultural Animals in Research and Teaching. 3rd ed. Federation of Animal Science Societies, 2441 Village Green Place, Champaign, IL 61822.
- BLACKSHAW, J. K., F. J. THOMAS, J. A. LEE (1997): The effect of a fixed free toy on the growth rate and aggressive behaviour of weaned pigs and the influence of hierarchy on initial investigation of toys. *Appl. Anim. Behav. Sci.* 53, 203-212.
- D'EATH, R. B., S. P. TURNER (2010): The natural behavior of the pig. In: *The Welfare of Pigs*. (Marchant-Forde, J. N., Ed.), Springer Science+Business Media B.V., pp. 13-46.
- DE GRAU, A., C. DEWEY, R. FRIENDSHIP, K. DE LANGE (2005): Observational study of factors associated with nursery pig performance. *Can. J. Vet. Res.* 69, 241-245.
- DOCKING, C. M., H. A. VAN DE WEERD, J. E. L. DAY, S. A. EDWARDS (2008): The influence of age on the use of potential enrichment objects and synchronisation of behaviour of pigs. *Appl. Anim. Behav. Sci.* 110, 244-257.
- LEMEL, J., J. TRUVÉ, B. SÖDERBERG (2003): Variation in ranging and activity behaviour of European wild boar *Sus scrofa* in Sweden. *Wildl. Biol.* 9 (Suppl. 1), 29-36.
- NEWBERRY, R. C. (1995): Environmental enrichment: Increasing the biological relevance of captive environments. *Appl. Anim. Behav. Sci.* 44, 229-243.
- NOWICKI, J., M. KOPYRA, C. KLOCEK (2007a): The behavioral reaction of weaners to hanging toys: wooden ball and aromatized wooden ball - way to reduce aggression after mixing. *J. Cent. Eur. Agr.* 8, 447-451.
- NOWICKI, J., M. KOPYRA, E. MOSKAŁA (2007b): The comparison of the behaviour of weaners housed after mixing in pen equipped with a hanging toy: object for biting and wooden ball. *J. Cent. Eur. Agr.* 8, 153-157.
- PEARCE, G. P., A. M. PATERSON, A. N. PEARCE (1989): The influence of pleasant and unpleasant handling and the provision of toys on the growth and behaviour of male pigs. *Appl. Anim. Behav. Sci.* 23, 27-37.
- PUPPE, B., M.-C. MEUNIER-SALAÜN, W. OTTEN, P. ORGEUR (2008): The welfare of piglets. In: *Welfare of Pigs: from Birth to Slaughter*. (Faucitano, L., A. L. Schaefer, Eds.), Wageningen Academic Publishers, The Netherlands & Éditions Quæ, Versailles, France, pp. 97-132.

G. Gregurić Gračner et al.: The effect of environmental enrichment on weight gain in weaned pigs

- RODARTE, L. F., A. DUCOING, F. GALINDO, M. C. ROMANO, R. A. VALDEZ (2004): The effect of environmental manipulation on behaviour, salivary cortisol and growth of piglets weaned at 14 days of age. *J. Appl. Anim. Welf. Sci.* 7, 171-179.
- RUITERKAMP, W. A. (1987): The behaviour of grower pigs in relation to housing systems. *Neth. J. Agric. Sci.* 35, 67-70.
- VAN DE WEERD, H. A., J. E. L. DAY (2009): A review of environmental enrichment for pigs housed in intensive housing systems. *Appl. Anim. Behav. Sci.* 116, 1-20.
- VUČEMILO, M., B. VINKOVIĆ, K. MATKOVIĆ (2006): Accommodation and welfare of farm animals, and conditions farms must comply with according to new regulations (in Croatian). *Krmiva* 48, 43-47.
- WARAN, N. K., D. M. BROOM (1993): The influence of a barrier on the behaviour and growth of early-weaned piglets. *Anim. Prod.* 56, 115-119.
- WOOD, C. M., B. OSBORNE, S. MEDER, A. YOUNG, A. DAMON, J. JOSEPH, M. ASHBY, T. O'HARE, L. A. KUEHN (2003): The effect of toys on performance and behavior of weanling pigs housed in littermate or mixed groups. *J. Anim. Sci.* 81 (Suppl. 2), 34 (abstract).

Received: 10 July 2012

Accepted: 5 December 2012

GREGURIĆ GRAČNER, G., N. ŠEMIGA, M. OSTOVIĆ, A. EKERT KABALIN, K. MATKOVIĆ, Ž. PAVIČIĆ: Učinak predmeta za obogaćenje okoliša na prirast odbijene prasadi. *Vet. arhiv* 83, 333-339, 2013.

SAŽETAK

Cilj istraživanja bio je procijeniti učinak predmeta za obogaćenje okoliša na prirast odbijene prasadi. Istraživanje je provedeno u dva istovjetna uzgajališta svinjogojske farme tijekom razdoblja uzgoja od 60 dana i uključilo je ukupno 208 odbijene prasadi Topigs hibrida. Prasad je bila podijeljena u pet skupina, kontrolnu (n=52) i 4 pokusne, obogaćene automobilskom gumom na podu, visećom loptom, loptom na podu odnosno visećim lancem (n=39 svaka). Tjelesna masa prasadi određivana je 0., 30. i 60. dana po odbiću. Rezultati istraživanja pokazali su da je u prvoj polovici uzgojnog razdoblja prirast prasadi u pokusnoj skupini obogaćenoj automobilskom gumom bio značajno veći ($P<0,05$) u odnosu na obje skupine obogaćene loptom. U istom razdoblju utvrđen je i značajno veći prirast ($P<0,05$) u pokusnoj skupini obogaćenoj visećim lancem u odnosu na skupinu s loptom na podu. Prirast u drugoj polovici uzgojnog razdoblja te ukupni prirast prasadi, u razdoblju od 0. - 60. dana, bio je značajno manji ($P<0,05$) u kontrolnoj te skupinama obogaćenima automobilskom gumom, odnosno lancem s obzirom na obje skupine obogaćene loptom. Može se zaključiti da učinak obogaćenja okoliša pojedinim predmetima na prirast odbijene prasadi ovisi o dobi prasadi te vrsti predmeta, pri čemu upravo lopta može biti učinkovita u poboljšanju prirasta.

Ključne riječi: svinje, prirast, obogaćenje okoliša, dobrobit životinja
