



Deep-litter pig keeping (A review)

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ABSTRACT

The study objective was to elaborate the system of pig keeping on deep litter, pointing out advantages and disadvantages of such system in comparison with conventional pig breeding systems. The study also presents future perspectives of deep litter pig keeping in Croatia. Raising of pigs on deep litter has only recently become acceptable as a way of production of high quality pigs and pig meat, mostly because of its ecological aspect and beneficial effects on pig welfare and health. Some contradictory research results referring to production and slaughtering characteristics, as well as to microclimatic conditions, indicate that further efforts have to be made in order to optimize deep litter pig keeping. Interventions in zootechnical procedures are aimed at optimization of pig production on deep litter in suitable climatic environment.

(Keywords: pigs, deep litter, welfare, health, meat quality)

INTRODUCTION

Regardless of keeping system, production of pigs should be oriented at provision of good production outcomes at the lowest possible costs. Such production results can be achieved only if considering all factors that affect production efficiency, as efficiency and profitability of overall pig production depend on the achieved production results. There is currently an emphasis put on welfare and health of pigs, as well as on ecological production of pig meat, which contributes to development of alternative pig keeping systems. Conventional ways of pig production cannot fulfill the requirements with respect to pig welfare and health. Recent trends indicate increasing popularity of deep litter pig keeping in countries with developed pig production, as well as in Croatia. Compared to conventional pig keeping systems, raising of pigs on deep litter has many advantages, such as beneficial effects on pig health and welfare, reduced occurrence of injuries and diseases, lowered production costs and ecological aspect (Margeta *et al.*, 2004; Kralik *et al.*, 2005). Referring to production and slaughtering characteristics, there are contradictory research results available, which point out the need for further researches on this topic in order to find optimal zootechnical and zoohygienic solutions necessary for adjusting deep litter pig keeping to specific conditions of a particular area. The aim of this review was to elaborate deep litter pig keeping system, pointing out advantages and disadvantages of such system compared to conventional pig farming systems and presenting possibilities of wider implementation of such system in Croatia.

Production characteristics of pigs

There are some contradictory results referring to reproductive and production characteristics of pigs kept on deep litter. Gutzmirtl (2009) stated that sows on deep litter had identical

number of piglets as sows kept on cross-bared floor, but the level of stress was significantly lower for sows on deep litter. Weaned pigs kept on deep litter weighed more and were more vital and healthy than weaned pigs kept conventionally. *Klont et al.* (2001), and *Honeyman and Harmon* (2003) stated that pigs kept on deep litter had in the finishing phase of fattening higher feed consumption, less feed conversion per kg of weight gain and higher average daily gain. *Beattie et al.* (2000) and *Kralik et al.* (2004) pointed out that pigs on deep litter had more favorable consumption and feed conversion than pigs kept in conventional systems. *Lambooj et al.* (2004) stated that pigs kept on deep litter had significantly higher weight of warm carcasses and better water holding capacity than pigs kept on cross-bared floor. Better capacity of water holding in muscle tissue was explained by the above mentioned authors as a consequence of pigs' intensive movement during fattening, which affected firmness and better structure of muscular tissue. *Margeta and Kralik* (2006) determined better slaughtering characteristics of pigs kept on deep litter (Table 1). *Gentry et al.* (2002) and *Maw et al.* (2001) did not detect significant differences in production characteristics between pigs kept on deep litter and conventionally fattened. On the other hand, *Gentry et al.* (2002), and *Morrison et al.* (2003) determined increased deposition of fatty tissue in carcasses of pigs kept on deep litter, as well as worse feed conversion and growth characteristics. *Kralik et al.* (2005) stated that keeping of pigs on deep litter had unfavorable effect on daily weight gain. The authors of the present study explain such occurrence by the fact that pigs on deep litter had less frequent feeding, but their average feeding lasted longer than in pigs kept within conventional systems. Less frequent feeding of pigs bred conventionally, as well as longer interval of feed consumption affected tissue division in pigs' body to be more in favor of fatty tissue than of muscle tissue.

Table 1

Slaughtering traits of fattening pigs kept on deep litter and conventionally

Trait	Statistical indicators	Way of fattening	
		Deep litter system	Conventional system
Live weight before slaughter (kg)	\bar{x}	100.70 ^b	109.13 ^a
	sd	2.70	4.92
	CV	2.68	4.51
	$s\bar{x}$	0.54	1.00
Fat thickness - S (mm)	\bar{x}	12.12 ^a	14.13 ^a
	sd	7.20	6.69
	CV	59.42	47.35
	$s\bar{x}$	1.44	1.37
Muscle thickness - M (mm)	\bar{x}	68.52 ^b	70.04 ^{ab}
	sd	6.00	4.89
	CV	8.76	6.99
	$s\bar{x}$	1.20	1.00
Lean meat percentage (%)	\bar{x}	59.29 ^a	57.71 ^a
	sd	6.42	6.63
	CV	10.82	11.48
	$s\bar{x}$	1.28	1.35

Source: *Margeta and Kralik*, 2006.

^{a,b} P<0.05

Klont et al. (2001) concluded that keeping of pigs on deep litter had many benefits on production and slaughtering characteristics of pigs. Pigs on deep litter were able to move around freely, which reduced stress susceptibility and increased growth and meat quality.

Microclimatic conditions

Deep litter as a means of pig keeping absorbs gases and moisture from excrement and urine, and in this way it directly provides for better microclimatic and zoohygienic conditions within facilities. Almost every material available in larger amounts that has certain absorption abilities and is not damaging for pigs' health and production characteristics, can be used as deep litter. There are also opposite research results with respect to microclimatic conditions of facilities. *Myczko* (2002) determined that emission of ammonia was significantly lower in facilities with deep litter than in conventional facilities, and *Klemola* (1998) stated that concentration of dust in the air was significantly lower in facilities with deep litter than in conventional ones. However, *Jeppsson* (2002) pointed out that pigs kept on deep litter had increased body temperature due to their physical activity, which consequently increased the content of NH_3 and CO_2 , as well as relative air moisture in the facilities with deep litter. *Margeta et al.* (2004) did not determine statistically significant differences between facilities with deep litter and without it with respect to air temperature and humidity, air circulation and level of carbon dioxide (CO_2) and ammonia (NH_3) in the air, but the values of carbon dioxide and ammonia were lower in deep-litter barns than their concentration in conventional systems (*Table 2*).

Table 2

Microclimatic parameters on deep-litter and conventionally keeping system

Parameter	Statistical indicators	Way of fattening	
		Deep litter system	Conventional system
Air humidity (°C)	\bar{x}	67.33 ^a	71.23 ^a
	sd	6.23	4.49
	CV	81.41	94.32
	$s \bar{x}$	1.69	1.61
Air circulation speed - (m/s)	\bar{x}	0.23 ^a	0.22 ^a
	sd	0.04	0.05
	CV	97.41	83.19
	$s \bar{x}$	0.01	0.02
NH_3 (ppm)	\bar{x}	9.36 ^a	11.39 ^a
	sd	1.71	1.69
	CV	74.26	75.36
	$s \bar{x}$	0.42	0.43
CO_2 (vol. %)	\bar{x}	0.12 ^a	0.14 ^a
	sd	0.04	0.06
	CV	71.67	64.15
	$s \bar{x}$	0.02	0.02

^a $P < 0.05$

Facilities

Facilities used for production of pigs on deep litter are still not commonly found in Croatia. This fact is quite surprising if considering low construction costs for such facilities and availability of litter which is produced on Croatian arable land in great amounts. Advantages of facilities for deep litter pig keeping are seen in up to 40% lower costs of construction if compared to conventional facilities, as they do not require expensive equipment, crossbars, channels, lagunas, etc. Facilities with deep litter require also more space per an animal, which positively affects animals' behavior (Sargent, 2001), reduces aggressiveness and injuries occurrence and enables better social and hierarchical relations within a group. Furthermore, facilities for keeping of pigs on deep litter do not need investments in ventilation systems, as air circulates naturally. All stated positive effects of deep litter keeping system on pigs' health and behavior have also a by-side effect on improvement of production and slaughtering characteristics of pigs.

CONCLUSIONS

Keeping of pigs on deep litter is an alternative, ecological pig production system. In comparison with conventional keeping systems, it has many advantages, the most important of which are its positive effect on pig welfare and health, and reduced disease and injury occurrence, which is in line with the EU requirements of provision for animal welfare. Referring to slaughtering characteristics, there are some opposite results on the beneficial effects on deep litter pig keeping. Microclimatic environment in facilities with deep litter is better than in facilities for conventional pig production, if required microclimatic and environmental norms are followed. Construction of facilities for deep litter pig keeping is up to 40% cheaper than for conventional facilities, and there are no limitations referring to environment protection. Keeping of pigs on deep litter is a suitable way of pig production for family farms in Croatia.

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