

Environmental enrichment for pigs – practical solutions according to the Commission Recommendation (EU) 2016/336

JACEK NOWICKI¹, MARTYNA MAŁOPOLSKA², MARIOLA PABIAŃCZYK¹,
DOROTA GODYŃ², TOMASZ SCHWARZ¹, RYSZARD TUZ¹

¹Faculty of Animal Breeding and Biology, University of Agriculture in Kraków, Poland

²National Research Institute of Animal Production in Balice n. Kraków

Abstract: *Environmental enrichment for pigs – law regulations and practical solutions – a review.* The public opinion is interested in purchasing high-quality and safe food products. This primarily concerns food of animal origin. Consumers pay more and more attention to the conditions in which animals are kept and question farm practices that are painful and cause suffering to animals. One of such procedures performed in piglets is cutting off tails. The pressure of public opinion has led to the changes in European legislation. Tail docking cannot be done routinely and instead, it is required that materials enriching environment for pigs should be provided. The features of such objects, as well as the materials from which they should be made, have been clearly defined in the regulations. The aim of the work is to answer the question how to enrich pig environment in slatted floor conditions, to be in compliance with the law and at the same time ensure the functionality of available solutions.

Key words: animal welfare, tail biting, environmental enrichment

EU LAW BACKGROUND

Period following after weaning is extremely critical stage of rearing pigs (Merlot et al. 2004). It determines the efficiency of production, but it is also important when the welfare of weaners

is taken into account. Usually during this time, unfamiliar weaners are placed in one pen and mixed together for economic reasons. Piglets separated from sows are in the new environment, which is related to the perception of fear they feel, and this often leads to aggression. The outbreak of aggression manifested in fights results from setting up a social hierarchy (Keeling and Gonyou 2001). Further pathological behaviours which appear during the fattening period are rarely dependent on the not stable hierarchy. Aggression may appear when the number of animals in the group exceeds their perception abilities. However, the main behavioural problem during fattening is tail-biting and other forms of cannibalism.

Directive 2008/120/EC specifying the minimum standards to ensure the welfare of pigs, states among other things, that pigs kept in groups must be protected from fights by the use of a large amount of litter or, if possible, by the introduction of other materials suitable for exploration and occupation.

It is worth to notice that, the research on the environmental enrichment for pigs did not start, however, with the

entry into force of the current Directive regulations. The Directive regulations were not formulated narrowly, but they were based on the long-term research. Previous law regulations focused exclusively on the need to use litter, as was in the case of earlier legal acts in the EU, drawing attention to the importance of satisfying natural behavioural needs of pigs – Council Directive (91/630/EEC) dated 19 November 1991 about the minimum standards for pigs as well as in the Directive 2001/93/EC dated 9 November amending the Directive 91/630/EEC.

In the existing Directive 2008/120/EC, in point 4 of annex 1 it was stated that: “(...) pigs must have permanent access to a sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such, which does not compromise the health of the animals.”

In 2016, European Commission released Commission Recommendation (EU) 2016/336 of 8 March 2016 on the application of Council Directive 2008/120/EC laying down minimum standards for the protection of pigs as regards measures to reduce the need for tail-docking.

THE ENVIRONMENTAL ENRICHMENT TRAITS ACCORDING TO THE RECOMMENDATION 2016/336

The Recommendation is much more strict than Directive in case of the traits which should characterize the environmental enrichment for pigs.

According to the paragraph 4 of mentioned Recommendation: “(...) enrich-

ment materials should enable pigs to fulfil their essential needs without compromising their health. For that purpose, enrichment materials should be safe and have the following characteristics: (a) Edible – so that pigs can eat or smell them, preferably with some nutritional benefits; (b) Chewable – so that pigs can bite them; (c) Investigable – so that pigs can investigate them; (d) Manipulable – so that pigs can change their location, appearance or structure....”

In the paragraph 5 we can read as follows: “(...) In addition to the characteristics listed in paragraph 4, enrichment materials should be provided in such a way that they are: (a) of sustainable interest, that is to say, they should encourage the exploratory behaviour of pigs and be regularly replaced and replenished; (b) accessible for oral manipulation; (c) given in sufficient quantity; (d) clean and hygienic”. The very important issue is that “In order to fulfil pigs’ essential needs enrichments material should meet all the characteristics listed in paragraphs 4 and 5”.

Recommendation categorises enrichment materials as:

- a) optimal materials – materials possessing all the characteristics listed in paragraphs 4 and 5 and therefore such materials can be used alone;
- b) suboptimal materials – materials possessing most of the characteristics listed in paragraphs 4 and 5 and therefore such materials should be used in combination with other materials;
- c) materials of marginal interest – materials providing distraction for pigs which should not be considered as fulfilling their essential needs and therefore optimal or suboptimal materials should also be provided.

PRACTICAL SOLUTIONS

It is hard to imagine that other material but fresh straw which is replaced daily, can fulfil together all the requirements mentioned above. On the other hand, both mentioned above legal acts do not seem to take fully into account litter-free systems (slats) for pigs and the evacuation of droppings. They were not and still are not designed and adapted to evacuate such materials as straw, wood sawdust etc. The enrichment of the environment in the form of straw can indeed pose a problem, if the straw gets into the system of the evacuation of droppings. In connection with this, there are important questions what features should have the elements enriching the slatted floor environment for pigs, and whether you can improve the comfort and the level of the welfare of piglets kept in the litter system by the application of additional solutions. One of the latest proposals suggests that when the enrichment of the environment of rearing cannot be provided in the form of straw or other type of bedding on the floor (for example in litter-free systems or grate systems), it is recommended that the enriching material should be offered in special trays. Some reports suggest that the straw with appropriate length (short stems) hinders the proper utilization of the evacuation system of droppings to a small extent (Westin et al. 2013). However, these data have not been verified yet on sufficient number of commercial farms. To meet the legal requirements, materials mentioned in the Directive should be placed in each pen for pigs. Very often they are provided with the minimal amount, replaced by things which are not compliant with the law requirements and chosen arbitrarily.

The indisputable issue is the fact that pigs have a natural tendency to explore the environment. These animals have evolved on partially wooded areas where they had to look for food in the soil. In spite of multi-generation selection, pigs still show internal motivation for exploration (Fraser et al. 1991). This need is particularly visible in the environment poor in stimuli (without enrichment), where manipulative behaviour is directed to a limited number of available elements (Rushen et al. 1993). In the environment poor in stimuli, strongly motivated propensity to foraging and exploration is directed to the other pigs in the pen (Lyons et al. 1995, Kelly et al. 2000) and its equipment (Lyons et al. 1995). This can lead to aggression and cannibalism (Beattie et al. 1995). In such conditions, abnormal behaviours happen more often (van de Weerd et al. 2005, Scott et al. 2006). The reduction of the frequency of agonist behaviour in the enriched environment, reflects the lesser need to reciprocate persistent provocations from other pigs (Beattie et al. 1995). Features, which the elements of the enrichment of environment of rearing pigs should show, are still the subject of scientific debate (EUWelNet 2013).

In the middle of the first decade in the XXI century, it was stressed that a very important feature of the object is the possibility to bite and chew. The object itself should have a pleasant smell for pigs and the possibility of deformation (van de Weerd et al. 2003). Pigs are especially interested in objects which are flexible, which when bitten, change their shape and can be destroyed after some time. This gives the pigs satisfaction and focuses their attention on a particular ele-

ment for a long time (van de Weerd et al. 2003, 2005, 2009, Scott et al. 2006). It has been proved that the elements providing the animals with occupation, reduce the level of aggression significantly and make that they are not so prone to respond to “provocations” of other individuals (Beattie et al. 1995). If the pigs cannot express their natural behaviour (especially exploratory behaviour), they become aggressive to such extent that they attack mainly the head, body side, abdomen and the neck of other individuals. Thus they make extensive injuries from bruising to deep wounds. However, the degree of aggression can be almost eliminated by the application of at least one element enriching the environment of rearing (van de Weerd 2006).

Straw stimulates and allows animals to give vent to the needs of exploration, searching for food, burrowing and chewing (Studnitz et al. 2007). In spite of the fact that the application of straw has serious defects such as cost, labour outlay, less hygiene, at present no other form of the enrichment of environment provides the same level of occupation as straw (Scott et al. 2006). Clean and dry straw that is regularly replaced, provides all the features that are interesting and attractive for pigs, i.e. straw is suitable for chewing, rooting and can be easily destroyed as well as straw may be eaten. Straw stimulates exploratory behaviour. The more straw is available, the higher number of these behaviors is expressed by pigs (Studnitz et al. 2007). However, clean straw, provided in large quantities, may not be an appropriate solution for all pig producers. In such situations, other materials mentioned in the legislation may be more appropriate.

Approximately 90% of the producers of pigs in the European Union keep animals on partially or completely slatted floor (Hendriks et al. 1998, Guy et al. 2013), therefore it is necessary to search for alternative forms of enriching the environment, possible to use in these conditions (Scott et al. 2006). Usually used on farms plastic tubes, chains, balls, bottles, tires do not meet all the features and requirements that would make them attractive for pigs. For example, a plastic tube or bottle is not edible, it is difficult to destroy and if you want to keep it clean when hanged over a pen, it quickly loses the value of novelty and pigs cease to be interested in it. Scott et al. (2006) compared the activity level of pigs housed in straw and on the slatted floor with plastic tubes as an enrichment and found that pigs spend more time interested in straw than plastic tubes. Increasing the number of toys with plastic tubes does not rise the occurrence of exploratory behaviour. Commercial Bite Rite – suspended cone with four attached tubes to bite, single tube suspended on the chain, two crossed tubes forming the so-called “helicopter”, suspended strips of material, balls of different size, chains, tires and many others, chosen when they are currently available are commonly used. Unfortunately, they do not meet all requirements mentioned in Commission Recommendation (EU) 2016/336. Moreover, none of these solutions offered the combination of the involvement of pigs in the exploration and manipulation with the snout, drawing the attention by stimulating the sense of smell, which is attractive for pigs. A predominant role in pigs is played by senses constituting the main adaptation

to the style of life of their ancestors, that is, smell and taste (Signoret et al. 1975). These senses play a vital role in wild boars in the search and selection of appropriate food and in social interactions. Pigs are omnivorous opportunists, which are able to eat almost every kind of food (e.g. Cronney et al. 2003). With a strongly developed smell, these animals are able to distinguish what is good for them and what is dangerous to eat. Probably some smells distinguished by these pigs can indicate a high level of protein, fat or carbohydrates in the food (Kyriazakis et al. 1990). Pigs learn smell and taste preferences from each other and younger individuals from their parents (Newberry and Wood-Gush 1985).

In the studies published by Nowicki et al. (2007a) attention was focused on the issue of the utilization of flavouring the element enriching the environment of pig rearing unprecedented then in the literature of subject so as to make it more attractive to draw the attention of these animals more. There is no doubt that the sense of smell plays a significant role in the process of the adaptation of pigs (Perry 1992, Kristensen et al. 2001, Jensen 2002, Nowicki and Klocek 2012). Pigs use smell not only to find food but also it serves them for social contacts (Mendl et al. 2002). On the other hand, there are many reports that pigs do not have a particularly well-developed sense of sight (Hutson et al. 1993, 2000, Lomas et al. 1998, Tanaka et al. 1998, Zonderland et al. 2008), that is why the attempts were made to find whether the application of smell objects, can affect the change in behaviour and facilitate the adaptation of piglets after weaning and joining the animals in a larger group by reducing time

and decreasing the frequency of agonistic behaviour. In spite of the Directive regulations, in the commercial pig farming systems the selection of objects, which enrich the environment for pigs, was often arbitrary and behavioural priorities of pigs were not taken into account. The consequence of such method of the enrichment of environment for pigs was a very fast lack of interest in this type of objects (Day et al. 2002)

A lot of reports show that the items placed on the floor of the pen can be very easily contaminated with droppings and eventually pigs – animals with a very sensitive sense of smell – quickly lose interest in them. It was the reason why in the literature the series of experiments using suspended objects which differed in case of the possibility of destruction, deformation, flavouring appeared in the last years (Nowicki et al. 2007a, b, 2008, Nowicki and Klocek 2012). All the experiments were performed on straw bedding pens for weaners and fatteners, so according to the mentioned EU regulation, the objects used may be called suboptimal materials, because most of them are destructible, chewable and investigable, however they are not edible. One of them (Nowicki et al. 2015) has very important feature, because it is equipped with the perforated container for changeable aromas, what ensures the novelty aspect. The interest in this object increases when the aroma is changed into the new one, and it makes it possible the decrease in dangerous and aggressive behaviours. This solution meets the hardest requirement of the Commission Recommendation (EU) 2016/336, because the container may be filled with edible aromatic material.

The number of enrichment objects placed in the pen is very important, as well. The Council Directive 2008/120/EC, annex 1, in point 4 laying down the general requirements on the prevention of tail-biting states that "...pigs must have permanent access to a sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such, which does not compromise the health of the animals". The quality and quantity of materials are very important and each pig should have free access to those materials and ability to express exploration behaviour. The limited, insufficient amount of materials lead to competition between pigs and can cause aggression (van de Weerd et al. 2006). The localization of enrichment materials and objects inside pen is essential, because it can stimulate pigs' interest. The enrichments should therefore be placed close to the ground and should stay clean (without faecal fouling). As mentioned above, the enrichment material that is soiled with faeces is not attractive to pigs which are characterized by perfect olfactory sense (Nowicki et al. 2008). It was found that when offered enrichment at different heights, pigs spend more time manipulating objects at ground level when compared to objects hanging 5 cm above floor level. Similarly, pigs manipulate these low-hanging objects more than those offered at snout level (Courboulay 2011).

Moreover, point 4 (Directive 2008/120/EC, annex 1) showed emphasis on animal's health. Inadequately collected and stored straw could be a source of bacteria, fungi and mold. Consequently, enriching materials and objects are potentially dan-

gerous for pigs as a reservoir of pathogenic bacteria and viruses. Another risk factor is material from which the enrichment objects are made. One of the desirable features for environmental enrichment is possibility of deformation and destructibility. However, the way in which these objects are destroyed may cause danger, for example, splinters of soft pine wood, or wires in tires. The enrichment material cannot be toxic, as well.

During the examinations of welfare, pigs should be observed in case of activity and interest of environmental enrichments. Following questions are useful to assess proper investigation: Does pigs have ability to express their natural behaviour connecting with searching and exploring environment elements? Are pigs able to eat, chew, root and destroy enrichment objects? Do pigs explore and try to manipulate other animals or other elements that are not enrichment of environment inside pen? Does each pig have permanent access to sufficient amount of enrichment objects inside a pen? Where the enrichment objects are located? Are the enrichment objects clean? Do pigs compete with each other for enrichment objects? Are the enrichment objects safe for pigs? Could they cause animal health risks?

ENVIRONMENTAL ENRICHMENT OR TAIL DOCKING PROCEDURE TO PREVENT TAIL BITING BEHAVIOUR?

In the barren environments, pigs are exposed to the lack of suitable enrichment substrate to explore and manipulate, which can cause pigs' frustration and may also lead to abnormal behaviour. The

behavioural problems are easy to notice and can lead to destructing behaviour such as tail and ear biting, cannibalism, stereotypies (belly-nosing, snout rubbing etc). Tail biting is a huge problem for both animal welfare and economics of pig production (Smulders et al. 2008). Tail biting is associated with a variety of pathological changes ranging from spinal abscesses to pyaemia in different parts of the body and may be related to the pigs' motivation to explore novelty, to search for food and general occupation (EFSA 2007b).

The enrichment materials and objects which stimulate rooting, exploring and foraging behaviour are the best way to prevent tail biting in pigs (Studnitz et al. 2007). The risk of occurring tail biting is lower while pigs have access to straw and artificial enrichment objects (Taylor et al. 2012). This underline the strong relationship between environmental enrichment, foraging and maintaining activity and the risk of occurrence tail biting. European Food Safety Authority (EFSA 2007b) reported that „there is little evidence that provision of toys such as chains, chewing sticks and balls can reduce the risk of tail biting”. While point 4, annex 1 Directive 2008/120/EC showed opposite relationship. In case of occurrence of tail biting, point 8 of the same Directive is an essential guide of herd maintenance: „Neither tail-docking nor reduction of corner teeth must be carried out routinely but only where there is evidence that injuries to sows' teats or to other pigs' ears or tails have occurred. Before carrying out these procedures, other measures shall be taken to prevent tail-biting and other vices, taking into account environment and stocking den-

sities. For this reason inadequate environmental conditions or management systems must be changed”.

ASSESSING THE RISK OF TAIL BITING IN PIGS ACCORDING TO THE COMMISSION RECOMMENDATION (EU) 2016/336

While environmental enrichment objects are the most effective method to prevent and/or reduce abnormal behaviour such as tail-biting, other risk factors were identified in pig production. Tail-biting may be a pathological behaviour caused by stress (Sinisalo et al. 2012). This complex behavioural syndrome appears to provide the initial stimulus of tail biting, mostly in barren or uncomfortable environment which encourage pigs to focus on pen mates and the blood (Kritas and Morrison 2007). The occurrence of the risk of tail-biting in pigs involves lack of opportunities to fulfil their natural need for exploration and foraging behaviour (especially in barren environments). Arey (1991) concluded that „tail-biting is a sign that something is wrong with the system whether it is due to boredom, overcrowding, poor ventilation or diet. Its prevention should be of paramount importance”. EFSA (2007b) analysed the risk assessment of tail biting in pigs based on information obtained from scientific papers and made the ranking of hazards. The main risk factor for tail-biting is barren environment (fully slatted versus solid floor) and lack of manipulable materials (such as straw, hay, adequate enrichment). While, the lowest level of risk were noted in factors such as cold stress and poor air quality. Interestingly, the high probability of

increase in the risk of ear and tail biting have been found in stocking density and high temperature inside piggery (EFSA 2007b). For this reason, inadequate environmental conditions or management systems have to be changed. To make a decision about the management changes, the factors triggering tail-biting should be identified. The Recommendation 2016/336 provides some solutions how to assess the risk of tail-biting in pigs.

The Recommendation states that tail biting in pigs is an aberrant behaviour which has a multi-factorial origin. It is the reason why when applying the general requirements on the prevention of tail-biting and thereby a reduction of routine tail-docking as laid down in annex 1 to Directive 2008/120/EC, Member States should take into account the best practices guidance based on scientific knowledge. According to the Recommendation, Member States should ensure that farmers carry out a risk assessment of the incidence of tail-biting based on animal and non-animal based indicators ('the risk assessment'). In addition, they should establish compliance criteria with the requirements set out in the legislation and make them publicly available on the website.

The table below, printed originally in Commission Staff Working Document (2016) presents the parameters to assess risk factors of tail biting included in the Recommendation 2016/336. The possible assessment methods were presented, as well.

Based on the results of this risk assessment method, appropriate management changes in farms should be considered, such as supplying appropriate enrichment materials, in accordance with

presented above requirements, comfortable environmental conditions, assuring a good health status and/or providing a balanced diet for pigs. The management changes should be done before the official inspection gives the permission for tail docking. Obviously, the effects of recommended management changes should be checked before the permission for tail docking.

The Commission Staff Working Document on best practices with a view to the prevention of routine tail docking and the provision of enrichment materials to pigs accompanying the document Commission Recommendation 2016/336 states that: "It is therefore advisable to monitor the risk factors, by keeping detailed records of the husbandry conditions of the pigs as well as any findings that may trigger an episode of tail biting. This may help in identifying the underlying cause of the problem and measuring how effective, in the case of an outbreak, the measures put in place are".

The identified hazards factors can be used for farmers to stop or prevent tail biting behaviour. Despite fact, that the wide range of factors increasing risk of tail biting is known, the exact triggering mechanism is still unclear. It should be emphasised that barren environment, in greatest degree increase risk of tail biting but in the same time, this behaviour have a multi-factorial origin. The risk factor that trigger the pathological behaviour is not necessarily a factor with greatest importance from assessment risk management point of view. Previous research results suggested that provision of fresh straw each day in farrowing environment might contribute to reduced tail biting later in life (Moinard et al. 2003).

TABLE. Animal welfare indicators to assess risks of tail-biting

Criteria	Non-animal based indicators	Animal based indicators
Presence of biting		<ul style="list-style-type: none"> – increased occurrence of tail lesions and tail biting behaviour – lowered tail posture – increased restlessness
Enrichment material	qualities of the material: <ul style="list-style-type: none"> – safe – edible – chewable – investigable – manipulable management should ensure: <ul style="list-style-type: none"> – sustainable interest – accessible – in sufficient quantity – clean 	<ul style="list-style-type: none"> – inappropriate exploratory behaviour (i.e. a low ratio of exploration directed to the enrichment material in comparison to that directed at pen fittings and/or other pigs) Indicators showing inappropriate provision of enrichment material: <ul style="list-style-type: none"> – presence of bitten tails – presence of severe skin lesions
Cleanliness	<ul style="list-style-type: none"> – material soiled with excreta – soiling of pen 	<ul style="list-style-type: none"> – increased false nest building in sows – increased disease – increased dirtiness of animals
Thermal comfort and air quality	occurrence of: <ul style="list-style-type: none"> – extreme or variable air temperature – high airspeed (draughts) – intense light level – high level of harmful gases, e.g. carbon dioxide, ammonia 	increased: <ul style="list-style-type: none"> – panting, shivering – poor body condition, poor coat condition – restlessness – red eyes – modified lying behaviour showing thermal discomfort
Health status	<ul style="list-style-type: none"> – poor biosecurity programme – inadequate vaccination programme 	increased: <ul style="list-style-type: none"> – panting, shivering – lying behaviour (i.e. resting periods) – coughing, sneezing, red eyes – diarrhea – variation in growth within the group
Competition for food and space	<ul style="list-style-type: none"> – high number of animals per square meter of floor surface – high number of animals per feeder – poor mixing management 	increased : <ul style="list-style-type: none"> – skin lesions – aggression – restlessness poor body condition
Diet	<ul style="list-style-type: none"> – changes in diet composition – lack of sodium (salt) in the diet – lack of amino-acids in the diet – lack of energy in the diet 	increased: <ul style="list-style-type: none"> – poor body condition, diarrhoea – poor coat condition – restlessness – foraging behaviour – gastric ulcers – variation in growth within the group

The multifactorial background of tail biting strongly relates to environmental risk factors, but very often even enrichment materials and rooting substrate could not be sufficient to prevent this pathological behaviour. For example straw do not reduce aggression after the pigs are mixed on the farm (e.g. after weaning) (Arey and Franklin 1995). According to Council Directive 2008/120/EC: “(...) other measures shall be taken to prevent tail-biting and other vices, taking into account environment and stocking densities”. Achieving an improvement of early detection of tail biting is possible by adequate, systematic evaluation and modification of management practices with properly organize, specific veterinary advice. Despite of different housing and husbandry systems, the farmers should be supported by advisors or assessors with the knowledge about identification and minimisation possible risk factors and how to prevent abnormal behaviour in pigs (EFSA 2007b).

During one control inside farm, experts and producers are able to detect and prioritise the risk factors of tail-biting, so farmers consequently could make a structural changes and those that require capital investment to change or management changes (Taylor et al. 2012). Suggested tail damage scale classes is presented below:

- a – no damage – no evidence for tail-baiting,
- b – minor damage – healed or mild lesions, evidence of chewing but no evidence of swelling (red areas in the tail are not considered as wounds unless associated with fresh blood),
- c – major damage – fresh blood is visible on the tail, evidence of swelling

and signs of possible infection, partial loss of the tail (Welfare Quality® Consortium 2009).

Tail biting usually appear during play, while pigs are lightly chewing and biting another pigs’ tail (without tail damage). While tail biting increase and results in wounds on the tail, bitten pigs may become more active or apathetic because of pain. Consequently, this lead to attract many pigs to bite or chew fresh blood, so pigs become aggressive and even cannibalism can occurred (Schröder-Petersen and Simonsen 2001). Bitten animals suffer pain, feel fear which can caused escape behaviour, especially inside small pens (no place to hide) without environmental enrichment materials (EFSA 2007a).

Schröder-Petersen and Simonsen (2001) reported that pigs’ tail is sensitive (peripheral nerves in the intact tip of the tail) so the pain from open tail wound could be acute (increased by infection) or pain from amputated tip may become a chronic pain. The bitten pig may become apathetic and may be characterized by a lack of appetite, reduction of body weight gain, weakness, loss of blood. Moreover, pigs with open tail wounds avoid open spaces such as eating from the feeder, to reduce further assault (Wallenbeck and Keeling 2013). Tail biting may lead to generalized infections and inflammatory states which result in deterioration quality of the carcass. The wounded tail may become infected, which causes abscesses in the adjacent tissue of the hindquarters and the posterior segment of the spinal column. Thus, even small tail wounds could be the place of infection and occurrence of pyaemia, which can lead to partial or full

condemnation of carcasses at slaughter (Grist 2007, Kritas and Morrison 2007).

The economic impact of tail biting was estimated for farms in Netherlands. If tail-biting occurred at the level 2.1%, the additional cost per one pig was estimated around 9.26 EUR. The fattening farm in herd to a 4,000 pigs, can lose up to 2,425 EUR. In Netherland the total costs caused by tail-biting was estimated to 8 million EUR per year. (Zonderland et al. 2011).

TAIL BITING AND TAIL DOCKING – INFLUENCE ON THE WELFARE OF PIGS

Both, tail biting and other welfare problems decreased producer's satisfaction of animal breeding and make it harder for the farmer (Kauppinen et al. 2010). Year by year, the level of education and awareness of animal welfare increase especially in European countries. The treaty on functioning of the European Union, article 13 described: "The Union and the Member States shall, since animals are sentient beings, pay full regard to the welfare requirements of animals, while respecting the legislative or administrative provisions and customs of the Member States (...)". Therefore, tail docking is described as: „(..) likely to cause immediate pain and some prolonged pain to pigs." (Directive 2008/120/EC). Tail docking, routinely used in many countries, is painful for piglets, because neuromas have been found in the tail stumps (Simonsen et al. 1991). The data about consequences of tail-docking such as chronic pain or discomfort are limited. However, research results suggested that tail docking can

cause chronic pain or sensitivity due to the development of traumatic neuromas in injured peripheral nerves (Sandercock et al. 2016). European Food Safety Authority (EFSA 2007b) estimated risk of chronic pain in case of tail docking in range from 0 to 1 as 0.998. For that reason, tail-docking is considered as a practice which has a detrimental effect on the welfare of pigs (Directive 2008/120/EC). Nevertheless, tail docking is commonly practiced by pig producers, and it is very effective and controversial method to prevent or reduce tail biting (Sutherland et al. 2011), it only masks real problems or pathology on farm and as a constrains routine should be minimalized or even changed for alternative methods in accordance to animal welfare.

The Directive clearly states that tail docking is detrimental to the welfare of pigs, so why is it still allowed (on large scale) as a method of preventing or combating the abnormal behaviour? It should be emphasised, that tail docking should be only conducted when other, non-invasive methods have failed. Some management factors are likely to reduce or prevent the probability to tail biting, but any of them are as effective as tail docking (Hunter et al. 2001). As a multifactorial syndrome, tail biting can be caused by many reasons (internal factors and behavioural mechanisms) depending of farm, so prevention methods which works on one farm are not always effective on the other farms (Schröder-Petersen and Simonsen 2001). Hunter et al. (2001) noted tail biting level in the whole analysed population of docked pigs 2.4% and 8.5% in the whole population of long-tailed pigs. In some analysed cases, docking a tail reduced occurrence

of tail-biting behaviour to 66% (Kritas and Morrison 2007). Nowadays, almost 90% of the pigs in Europe belong to the docked population, which is a consequence of high efficiency of this method in intensive housing systems (EFSA 2007b).

Problem of tail biting can occur even in tail docked population under unfavourable condition persist. This indicate, that tail docking is a reduction method, not (as was previously expected) method of removing tail biting syndrome (EFSA 2007b). Therefore, discussed Directive informed that „pigs should benefit from environment corresponding to their needs for exercise and investigatory behaviour”, and the improvement of pig’s welfare and environment should be considered as a priority.

In some European countries such as: Sweden, the practice of tail docking is totally forbidden. Pigs with undocked tails can be at high risk of harmful social behaviour, thus environmental enrichments and straw bedding are required in this country because of the greatest impact on the prevention of abnormal behaviour (van de Weerd et al. 2005). According to EFSA (2007b), “the undocked pigs are kept in systems where hazard for tail biting are less prevalent (pigs have access to enrichment materials such as straw and additional space)”. The Swiss research results showed positive effect of enrichment materials and daily access to outdoor in housing systems on health and welfare of pigs (Cagienard 2005). Consequently, tail docking can be avoided when high-stimulus environment is provided and pigs can exhibit their natural behaviour (rooting, foraging behaviour).

Relationship between environmental enrichments and tail biting is very strong (next to the proper management of other risk factors) so the best indicator for good pig welfare (for weaned, growing and finishing pigs) is tail without any signs of damage (EFSA 2011). Additionally, “it stands for high-quality management and respect for the integrity of the pig”.

It seems to be reasonable to think twice before making decision about tail docking. “Before carrying out these procedures, other measures shall be taken to prevent tail-biting and other vices, taking into account environment and stocking densities. For this reason inadequate environmental conditions or management systems must be changed” (Council Directive 2008/120/EC, annex 1, chapter 1, point 8).

Once the animal welfare assessment has been carried out on the farm, it is useful to have a specific guide for another inspection process. All breeders and producers are obligated to maintain their herd with compliance of regulations. To improve control of pig welfare, in 2013, e-learning training on pig housing and management was carried out (EUWelNet 2013, Hothersall et al. 2016). When the tail biting occurred, appropriate changes in herd management must be made, with reference to risk factors in order to reduce and stop the cannibalistic behaviour. If the initial changes in management are not effective, then subsequent ones must be introduced. This process of introducing subsequent, appropriate changes should be continued until the tail biting and cannibalistic behaviour is ceased completely. When tail-biting is stopped, the next batch of pigs should be reared without tail docking. Local veterinary inspectors

may allow to shorten tails by farmers, only as a short-term solution. However, producers are obligated to make appropriate changes in the herd management to: firstly – reduce tail docking and secondly – completely stop tail-docking.

Summing up, it should be stated that the choice of enrichment for pigs in slatted floor systems is very difficult, but it should be remembered that law regulations are more and more strict and rigorous because of the pressure of public opinion on the politics. Each farm must have its own solutions to prevent abnormal behaviours in pigs, but all of them should meet law requirements. However, the perception of legal regulations cannot be uncritical. The guidelines set out in the Recommendation to the directive are clear and can also be met using materials other than straw bedding or straw available for pigs from special feeders. It seems, however, that the Commission Staff Working Document on best practices with a view to the prevention of routine tail docking and the provision of enrichment materials to pigs accompanying the document Commission Recommendation 2013/336 is excessively detailed, as it lists the types of enrichment of the environment that are assigned to the appropriate categories of optimal, suboptimal and marginal interest. It seems that these exemplary materials (presented in this document) may affect the assessment of the farm made by the official institutions when the official inspectors focus only on the mentioned in this document materials. However, it is stated that this list is not exhaustive and the materials are not ranked as well as other materials may be used if they meet legal requirements.

In our opinion, it is important for the inspectors to consider each situation individually, focus not only on mentioned enrichment materials but also taking into account the features of each farm separately, especially in the farms where using straw or other bedding material may cause problems with flooding of manure.

Acknowledgements

The paper was supported from Statutory Activity (DS3265).

REFERENCES

- AREY D.S. 1991: Tail-biting in pigs. *Farm Build. Prog.* 105: 20–23.
- AREY D.S., FRANKLIN M.F. 1995: Effects of straw and unfamiliarity on fighting between newly mixed growing pigs. *Appl. Anim. Behav. Sci.* 45: 23–30.
- BEATTIE V.E., WALKER N., SNEDDON I.A. 1995: Effects of environmental enrichment on behaviour and productivity of growing pigs. *Anim. Welf.* 4: 207–220.
- CAGIENARD A., REGULA G., DANUSER J. 2005: The impact of different housing systems on health and welfare of grower and finisher pigs in Switzerland. *Prev. Vet. Med.* 68: 49–61.
- COMMISSION RECOMMENDATION (EU) 2016/336 of 8 March 2016 on the application of Council Directive 2008/120/EC laying down minimum standards for the protection of pigs as regards measures to reduce the need for tail-docking; C/2016/1345.
- COMMISSION STAFF WORKING DOCUMENT 2006: on best practices with a view to the prevention of routine tail docking and the provision of enrichment materials to pigs; Accompanying the document Commission Recommendation on the application of Council Directive 2008/120/EC laying down minimum standards for the protection of pigs as regards measures to reduce the need for tail-docking Brussels, 2016. Retrieved from: https://ec.europa.eu/food/sites/food/files/animals/docs/aw_practice_farm_pigs_stfwrkdoc_en.pdf (accessed: 16.10.2018).

- COURBOULAY V. 2011: Utiliation de différentes modalités de mise à disposition de chaînes pour des porcs en engraissement: impact sur le comportement et les lésions des animaux. *J. Rec. Por.* 43: 183–184.
- CRONEY C.C., ADAMS K.M., WASHINGTON C.G., STRICKLIN W.R. 2003: A note on visual, olfactory and spatial cue use in foraging behaviour of pigs: Indirectly assessing cognitive abilities. *Appl. Anim. Behav. Sci.* 83: 303–308.
- DAY J.E.L., SPOOLDER H.A.M., BURFOOT A., CHAMBERLAIN H.L., EDWARDS S.A., 2002: The separate and interactive effects of handling and environmental enrichment on the behaviour and welfare of growing pigs. *Appl. Anim. Behav. Sci.* 75: 177–192.
- EFSA 2007a: Scientific report on the risks associated with tail biting in pigs and possible means to reduce the need for tail docking considering the different housing and husbandry systems. *The EFSA Journal* 611: 1–13.
- EFSA 2007b: Animal health and welfare in fattening pigs in relation to housing and husbandry. *The EFSA Journal* 564: 1–14.
- EFSA2011: Technical Report, Prepared by Spoolder H., Bracke M., Mueller-Graf C., Edwards S. Retrieved from: <http://www.efsa.europa.eu/en/supporting/doc/178e.pdf> (accessed:10.04.2018).
- EU Directive 2008/120/EC 2008: Laying down minimum standards for the protection of pigs. *Official Journal L* 47.
- EUWELNET 2013: EUWELNET Pig training: Understanding environmental enrichment and tail docking requirements for finisher pigs in accordance with EU Directive 2008/120/EC. Available at www.euwelnet.eu (accessed: 10.04.2018).
- FRASER D., PHILLIPS P.A., THOMPSON B.K., TENNESSEN T. 1991: Effects of straw on the behavior of growing pigs. *Appl. Anim. Behav. Sci.* 30: 307–318.
- GRIST A. 2007: Porcine meat inspection: anatomy, physiology and disease conditions. Nottingham University Press, Nottingham, UK.
- GUY J.H., MEADS Z.A., SHIEL R.S., EDWARDS S.A. 2013: The effect of combining different environmental enrichment materials on enrichment use by growing pigs. *Appl. Anim. Behav. Sci.* 144: 102–107.
- HENDRIKS H.J.M., PEDERSEN B.K., VERMEER H.M., WITTMANN M. 1998: Pig housing systems in Europe: Current distributions and trends. *Pig News Inform.* 19: 97N–104N.
- HOTHERSALL B., WHISTANCE L., ZEDLACHER H., ALGERS B., ANDERSSON E., BRACKE M., COURBOULAY V., FERRARI P., LEEB C., MULLAN S., NOWICKI J., MEUNIER-SALAÜN M.-C., SCHWARZ T., STADIG L., MAIN D. 2016: Standardising the assessment of environmental enrichment and tail docking legal requirements for finishing pigs. *Anim. Welf.* 25: 499–50
- HUNTER E.J., JONES T.A., GUISE H.J., PENNY R.H.C., HOSTE S. 2001: The relationship between tail biting in pigs, docking procedure and other management practices. *T. Vet. J.* 161(1): 72–79.
- HUTSON G.D., AMBROSE T.J., BARNETT J.L., TILBROOK A.J. 2000: Development of a behavioural test of sensory responsiveness in the growing pig. *Appl. Anim. Behav. Sci.* 66: 187–202.
- HUTSON G.D., DICKENSON L.G., WILKINSON J.L., LUXFORD B.G. 1993: The response of sows to novel visual, olfactory and tactile stimuli. *Appl. Anim. Behav. Sci.* 35: 255–266.
- JENSEN P. 2002: Ethology of domestic animals: an introductory text. CABI Publishing, Wallingford, UK, 1: 218.
- KAUPPINEN T., VAINIO A., VALROS A., RITA H., VESALA K.M. 2010: Improving animal welfare: qualitative and quantitative methodology in the study of farmers' attitudes. *Anim. Welf.* 19(4): 523–536.
- KEELING L.J., GONYOU H.W. 2001: Social behaviour in farm animals. *CAB Intern.* 147–157.
- KELLY H.R.C., BRUCE J.M., ENGLISH P.R., FOWLER V.R., EDWARDS S.A. 2000: Behaviour of 3-week weaned pigs in straw – flow, deep straw and flat deck housing systems. *Appl. Anim. Behav. Sci.* 68: 269–280.
- KRISTENSEN H.H., JONES R.B., SCHOFIELD C.P., WHITE R.P., WATHES C.M. 2001: The use of olfactory and other cues for social recognition by juvenile pigs. *Appl. Anim. Behav. Sci.* 72: 321–333.
- KRITAS S.K., MORRISON R.B. 2007: Relationships between tail biting in pigs and disease le-

- sions and condemnations at slaughter. *T. Vet. Rec.* 160: 149–152.
- KYRIAZAKIS I., EMMANS G.C., WHITTEMORE C.T. 1990: Diet selection in pigs – choices made by growing pigs given foods of different concentrations. *Anim. Prod. Sci.* 51: 189–199.
- LOMAS C.A., PIGGINS D., PHILLIPS C.J.C. 1998: Visual awareness. *Appl. Anim. Behav. Sci.* 57: 247–257.
- LYONS C.A.P., BRUCE J.M., FOWLER V.R., ENGLISH P.R. 1995: A comparison of productivity and welfare of growing pigs in four intensive systems. *Livest. Prod. Sci.* 43: 265–274.
- MENDL M., RANDLE K., POPE S. 2002: Young females can discriminate individual differences in odours from conspecific urine. *Anim. Behav.* 64: 97–101.
- MERLOT E., MEUNIER-SALAÜN M.C., PRUNIER A. 2004: Behavioral, endocrine and immune consequences of mixing in weaned piglets. *Appl. Anim. Behav. Sci.* 85: 247–257.
- MOINARD C., MENDL M., NICOL C.J., GREEN L.E. 2003: A case control study of on farm risk factors for tail biting in pigs. *Appl. Anim. Behav. Sci.* 81(4): 333–355.
- NEWBERRY R.C., WOOD-GUSH D.G.M. 1985: The suckling behaviour of domestic pigs in a semi-natural environment. *Behav.* 95: 11–25.
- NOWICKI J., KOPYRA M., KLOCEK C. 2007a: The behavioural reaction of weaners to hanging toys: wooden ball and aromatized wooden ball – way to reduce aggression after mixing. *J. Cent. Eur. Agric.* 4(8): 447–452.
- NOWICKI J., KOPYRA M., MOSKAŁA E. 2007b: The comparison of the behaviour of weaners housed after mixing in pen equipped with a hanging toys: object for biting and wooden ball. *J. Cent. Eur. Agric.* 2(8): 153–158.
- NOWICKI J., MOSKAŁA E., KOPYRA M. 2008: Behavioural response of mixed weaners to a hanging wooden ball and a free ball in the pen. *Ann. Anim. Sci.* 1(8): 63–69.
- NOWICKI J., KLOCEK C. 2012: The effect of aromatized environmental enrichment in pen on social relations and behavioural profile of newly mixed weaners. *Ann. Anim. Sci.* 12(3): 403–412.
- NOWICKI J., ŚWIERKOSZ S., TUZ R., SCHWARZ T., 2015: The influence of aromatized environmental enrichment objects with changeable aromas on the behaviour of weaned piglets. *Vet. Arhiv.* 85(4): 425–435.
- PERRY G.C. 1992: Olfaction and taste. In: C.J.C. Phillips, D. Piggins (Eds), *Farm animals and the environment*. CABI Publishing, Wallingford, UK. 185–199.
- RUSHEN J., LAWRENCE A.B., TERLOUW E.M. 1993: The motivational basis of stereotypies. In: A.B. Lawrence, J. Rushen (Eds.), *Stereotypic Animal Behavior. Fund. Appl. Welf.* CAB Inter. 41–65.
- SANDERCOCK D.A., SMITH S.H., GIMINIANI P.D., EDWARDS S.A., 2016: Histopathological Characterization of Tail Injury and Traumatic Neuroma Development after Tail Docking in Piglets. *J. Com. Path.* 1(155): 40–49.
- SCHRØDER-PETERSEN D.L., SIMONSEN H.B. 2001: Tail biting in pigs. *T. Vet. J.* 162(3): 196–210.
- SCOTT K., TAYLOR L., GILL B.P., EDWARDS S.A. 2006: Influence of different types of environmental enrichment on the behaviour of finishing pigs in two different housing systems. 1. Hanging toy versus rootable substrate. *Appl. Anim. Behav. Sci.* 99: 222–229
- SIGNORET J.P., BALDWIN B.A., FRASER S. HAFEZ E.S.E. 1975: The behaviour of swine. In: E.S.E. Hafez (Ed), *The Behaviour of Domestic Animals*. Tindall and Cox. London. 295–329.
- SIMONSEN H.B., KLINKEN L., BINDSEIL E. 1991: Histopathology of intact and docked pig tails. *T. Brit. Vet. J.* 147(5): 407–412.
- SINISALO A., NIEMI J.K., HEINONEN M., VALROS A. 2012: Tail biting and production performance in fattening pigs. *Livest. Sci.* 143(2–3): 220–225.
- SMULDERS D., HAUTEKIET V., VERBEKE G., GEERST R. 2008: Tail and ear biting lesions in pigs: an epidemiological study. *Anim. Welf.* 17: 61–69.
- STUDNITZ M., JENSEN M.B., PEDERSEN L.J. 2007: Why do pigs root and in what will they root? A review on the exploratory behaviour of pigs in relation to environmental enrichment. *Appl. Anim. Behav. Sci.* 107(3–4): 183–197.
- SUTHERLAND M.A., DAVIS B.L., MCGLONE J.J. 2011: The effect of local or general

- anesthesia on the physiology and behavior of tail docked pigs. *Anim.* 5(8): 1237–1246.
- TANAKA T., MURAYAMA Y., EGUCHI Y., YOSHIMOTO T. 1998: Studies on visual acuity of pigs using shape discrimination learning. *Anim. Sci. Technol.* 69: 260–266.
- TAYLOR N.R., PARKER R.M.A., MENDEL M., EDWARDS S.A., MAIN D.C.J. 2012: Prevalence of risk factors for tail biting on commercial farms and intervention strategies. *T. Vet. J.* 194(1): 77–83.
- WALLENBECK A., KEELING L., 2013: Using data from electronic feeders on visit frequency and feed consumption to indicate tail biting outbreaks in commercial pig production. *J. Anim. Sci.* 91(6): 2879–2884.
- WEERD H.A. van de., DAY J.E.L. 2009: A review of environmental enrichment for pigs housed in intensive housing systems. *Appl. Anim. Behav. Sci.* 116: 1–20.
- WEERD H.A. van de, DOCKING C.M., DAY J.E.L., AVERY P.J., EDWARDS S.A. 2003: A systematic approach towards developing environmental enrichment for pigs. *Appl. Anim. Behav. Sci.* 84(2): 101–118.
- WEERD H.A. van de, DOCKING C.M., DAY J.E.L., BREUER K., EDWARDS S.A. 2006: Effects of species relevant environmental enrichment on the behaviour and productivity of finishing pigs. *Appl. Anim. Behav. Sci.* 99 (3–4): 230–247.
- WEERD H.A. van de, DOCKING C.M., DAY J.E.L., EDWARDS S.A. 2005: The development of harmful social behaviour in pigs with intact tails and different enrichment backgrounds in two housing systems. *Anim. Sci.* 80(3): 289–298.
- WELFARE QUALITY® ASSESSMENT PROTOCOL FOR PIGS. 2009: Sows and piglets, growing and finishing pigs. Welfare Quality® Consortium, Lelystad, Netherlands.
- WESTIN R., HOLMGREN N., MATTSSON B., ALGERS B. 2013: Throughput capacity of large quantities of chopped straw in partly slatted farrowing pens for loose housed sows. *Acta Agricult. Scand., Sect. A – Anim. Sci.* 63: 1–10.
- ZONDERLAND J.J., CORNELISSEN L., WOLTHUIS-FILLERUP M., SPOOLDER H.A.M. 2008: Visual acuity of pigs at different light levels. *Appl. Anim. Behav. Sci.* 111: 28–37.
- ZONDERLAND J.J., BOSMA B., HOSTE R. 2011: Report on the financial consequences of tail damage due to tail biting among pigs in conventional pig farms in the Netherlands. *Livest. Res. Wageningen UR report 543: 1570–8616.*
- Streszczenie:** *Wzbogacanie środowiska dla świń – praktyczne rozwiązania zgodnie z zaleceniem Komisji (UE) 2016/336.* Opinia publiczna jest zainteresowana nabywaniem wysokich jakościowo i bezpiecznych produktów żywnościowych. Dotyczy to także, a może nawet przede wszystkim żywności pochodzenia zwierzęcego. Konsumenty zwracają coraz większą uwagę na warunki, w jakich utrzymywane są zwierzęta i kwestionują praktyki fermowe, które sprawiają zwierzętom cierpienie. Jednym z takich zabiegów wykonywanych u prosiąt jest obcinanie ogonów. Naciski opinii publicznej doprowadziły do zmian europejskiego prawodawstwa. Obcinanie ogonów nie może być wykonywane rutynowo, a zamiast tego wymaga się aby w kojach dla świń zapewniać materiały wzbogacające środowisko ich chowu. Cechy takich obiektów, jak i materiały z których zostały wykonane zostały jasno określone w przepisach. Celem pracy jest odpowiedź na pytanie, jak wzbogacać środowisko chowu świń w warunkach bezściolowych, aby pozostawać w zgodzie z prawem, a jednocześnie zapewnić funkcjonalność dostępnych rozwiązań.
- Słowa kluczowe:* dobrostan zwierząt, gryzienie ogonów, wzbogacenie środowiska chowu świń
- MS received 12.06.2018*
MS accepted 30.10.2018
- Authors' address:**
Jacek Nowicki
Zakład Hodowli Trzody Chlewnej i Drobnego Inwentarza
Wydział Hodowli i Biologii Zwierząt,
Uniwersytet Rolniczy im. Hugona Kołłątaja
w Krakowie
al. Mickiewicza 24/28, 30-059 Kraków
Poland
e-mail: j.nowicki@ur.krakow.pl