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[1] Department of Pig Breeding and Production Technology, [2] Department of Biological Basis of Animal Production, University of Life Sciences in Lublin
Akademicka 13, 20-950 Lublin, e-mail: marek.babicz@up.lublin.pl

SYLWIA PAPROCKA[1], MAREK BABICZ[1], KINGA KROPIWIEC-DOMAŃSKA[1], PATRYCJA KOŁODZIEJ[1], KONRAD GRZESIUK[1], SEBASTIAN KNAGA[2]

The behavioural pattern of domestic swine (*Sus scrofa f. domestica*) and the possibility of its use in breeding and rearing. A review

Wzorzec behawioralny świni domowej (*Sus scrofa f. domestica*) – możliwości jego wykorzystania w hodowli i chowie. Praca przeglądowa

Summary. The aim to this study was to discuss the behaviour of pigs and the possibility of using that knowledge in the husbandry and production practice. Particular attention was paid to the relationship between welfare and behaviour of pigs. As it was shown, an effective way to prevent behavioural problems is to ensure that animals have the materials that absorb their attentions. The use of so-called toys supports the reduction of violence and stress in the group. As shown pigs prefer edible toy having flavor and odor. The ability to read signals, connected with knowledge of their behaviour is a crucial diagnostic tool that allows for the optimal utilization of production capacities of individual technological groups.

Key words: pigs, breeding, behaviour, manipulative materials – toys

INTRODUCTION

Pigs are gregarious animals, that show interest in the environment and have got a very high intelligence quotient. They have the ability to learn quickly and use knowledge e.g. to locate the food. They can also learn from other individuals and exploit their knowledge. A characteristic feature of pigs' behaviour is the constant search for novelty (exploration), on which approx. 20% of their motor activity is spent [Held *et al.* 2002]. This behaviour occurs due to the inborn curiosity of those animals and discloses primarily in new situations or in the presence of new elements. The exploratory behaviour consists of digging, biting and chewing. Those activities allow the animal to familiarize with an unknown object [Empel 2005]. Learning about pigs behaviour allows to obtain satisfactory results in terms of production, as well as helps to prevent dangerous accidents when managing animals.

EXPLORATORY BEHAVIOUR

Exploration is an orientation and cognitive activity of an individual in its environment and it is a result of curiosity. Wild pigs spend 75% of the day time for activities such as digging, grazing, chewing and exploring the environment. Despite many years of genetic modifications, pigs still have a strong need for exploration. Thanks to the excellent sense of smell and a strong snout, they are able to find small invertebrates, fungi, roots, and seeds hidden beneath the ground. The animals, through exploration, meet the need for stimulation and gain information about their environment. Piglets from the first days of life feel strong need to penetrate the surroundings. Exploratory behaviour is more intense when it comes to juveniles than adults, because the piglets are just learning environmental features. Between 4th–5th week and 7th–8th month of age dentition of pigs changes [Santen and Donselaar 2014]. During this period, the animals feel a greater need to chew, so more cases of cannibalistic behaviour has been observed. Exploratory behaviour can sometimes take the form of playful behaviour [Kaleta 2007]. Some animals, while playing, show activity that seems to have no obvious purpose. This may include: fake escapes, jumping without visible obstacles, self-fun (e.g. with a ball) and others. A depleted environment of large-scale farms in which some pigs live, significantly reduces the possibility of satisfying behavioural needs. Pigs deprived of the possibility to manifest the natural behaviour, are prone to various types of pathological behaviour such as anomalies and stereotypies. In order to know the consequences of reducing the manifestations of exploratory behaviour, it is necessary to understand how animals receive stimuli from the environment [Pisula 2003].

COMMUNICATION

Understanding the signals that animals send to humans and to animals of their own species is crucial when it comes to the veterinary and behavioural diagnosis. For this purpose, it is essential to have the knowledge on how the stimuli are received from the environment. In the case of pigs the biggest roles in the communication have the organs of smell and hearing; the eyesight is less important [Hulsen and Scheepens 2014].

Vocalization

Pigs communicate by using 20 different vocalizations, such as: grunting, squealing and murmurs. The frequency and duration of notes emitted by the pigs can be used to interpret the animals' needs at the time. The typical grunt lasts 0.25 sec. – 0.4 sec. and usually is a respond to a familiar sound. The sounds of different intensity or frequency have completely different meanings. An acute, short grunt lasting 0.1–0.2 sec. are emitted by the excited animals. The amplified, short and sharp grunts are used by the sow as a warning signal and may precede the attack. A milder form of these sounds may be considered as a welcome. Pigs through a long (0.4–1.2 sec.) grunt establish contact with each other and generally express satisfaction. These sounds are usually associated with pleasant tactile stimuli. Short grunts are an alarm signal that informs about the threat (e.g. the entrance of a stranger into the pig house). Piercing squeals are typical signs of stress emitted by e.g. the vaccinated piglets. The sounds like barking can be interpreted as

a sign of a surprise. The pigs signal hunger through a series of 20 contiguous grunts. An increased vocalization occurs when an individual is isolated and placed in a location unknown to a pig. In a state of chronic pain pigs gnash their teeth [Houpt 2011].

At the pig house, piglets usually suck sows at one time, because as one sow convene her young, she also stimulate the rest for the same reaction. The piglets that are separated from their mothers squeal or grunt through closed snouts approx. 21 times per minute. Vocalization increases in direct proportion to the time spent without a mother. Another characteristic sound that sows create during the heat is called "hum" and it belongs to a number of characteristics features of sexual behaviour [Allen *et al.* 2007].

Visual signals

In the case of pigs visual signals are body language and position of the tail [Allen *et al.* 2007]. The tail position is an excellent welfare indicator of many pig breeds. Tightly curled tail is a symptom of health, while straight means illness or suffering (the exception is Asian group i.e. Vietnamese breed). During sleep pigs' tails are straight, but they twist immediately after waking up.

Olfaction signals

Pigs' most developed sense is smell it is the most crucial when it comes to the gregarious life and reproduction. Piglets, almost immediately after the birth, are forced to recognize the smell of their mother and siblings [Barowicz 1999]. Boars flawlessly read olfactory signals to determine the readiness of sows to be covered. These are the only ungulates that do not manifest flehmen response, which consists in exposing the gums and flanging lips. Instead, in order to detect pheromones, they open snout when the sow urinates. Females are able to recognize a male due to a strong smell. Boars' pheromones are collected in mandibular gland, in which proteins bind the pheromones. Sex steroids are also present in sweat and adipose tissue. Males after the removal of mandibular glands do not arouse the characteristic sexual behaviour [Houpt 2011].

AGGRESSION AND SOCIAL STRUCTURE

Hierarchy

Pigs are gregarious animals and from the first days after birth they begin to fight for position in the hierarchy. According to Grudniewska [1995], the hierarchy is determined after 4–5 days after the birth. Typically, a pig which is born early goes off for the nipple with the most milk and later takes a dominant position. The stable situation in the herd minimizes the risk of fights as any changes in heard structure are powerful stress factors. When connecting piglets from different litters fights occur. They last typically 30–60 minutes until the appearance of dominant unit. The intensity of the clashes decreases in time and after approx. 24–48 hours the hierarchy is fixed. At this stage, different types of roles are distinguished: the dominant and subdominant. There are also composed, subordinated and marginal subjects (Table 1). The level of aggressiveness among the individuals is connected with the position in the group [Kittawornrat and Zimmerman 2010]. The

animal behaviour also depends on their sex. According to Gronek [1997], females are more submissive to other subjects, have a greater need for security and have a softer temper. Males are more independent, they are more aggressive and have stronger need for domination [Jabłoński 2009].

Table 1. The analysis of pigs' hierarchical levels (by Grudniewska 1995)
Tabela 1. Analiza poziomów hierarchicznych u świń (wg Grudniewskiej 1995)

Position in the group Pozycja w grupie	Characteristics Charakterystyka
Dominant Dominant	- aggressive/ agresywny - willing to take the fight/ gotów podjąć walkę - usually wins/ zazwyczaj wygrywa - provokes others to fight / prowokuje innych do walki
Subdominant Subdominant	- hardly ever fights/ rzadko walczy - usually losses / zwykle przegrywa
Subordinated subject Osobnik podporządkowany	- aggressive/ agresywny - willing to take the fight/ gotów podjąć walkę - losses to dominants/ przegrywa z dominantami
Composed subject Osobnik opanowany	- fights not very often/ nie walczy często - losses to higher rank subjects/ przegrywa z osobnikami wyższej rangi
Marginal subject Osobnik marginesowy	- timid/ nieśmiały - avoid fights/ unika walki - usually losses/ zwykle przegrywa

Aggression

The causes that make pigs aggressive are all negative changes in the environment, among others, overcrowding, as well as dietary mistakes e.g. unbalanced ration [Jabłoński 2013]. In order to minimize the risk of aggressive behaviour, an access to exploration materials should be provided. What is more, created groups should be similar when it comes to age and weight but also it is necessary to allow the subjects in the group to incept feed and water simultaneously [Pejsak 2007].

Cannibalism as a behavioural anomaly is being observed more and more often in large scale pig houses, both in groups of older piglets and porkers. This problem especially occurs in the non-bedding system where the environment is monotonous. In the case of pigs, this behaviour can take many forms, e.g. biting the tails and ears of other subjects, biting own body parts or even eating piglets by sows (so called filial cannibalism) There are many reasons for such a behaviour but the main factors that conduce cannibalism include: dietary mistakes (deficiency of protein, sulphur amino acids and vitamin B12), sensory deprivation or small differences in stimuli, disease factors, too large cast, improper microclimate conditions and too intense illumination. Individual factors that affect the occurrence of this phenomenon are: race, age and sex [Pejsak 2007]. Pigs, that are considered victims suffer both physically and mentally. The pain and fear of attack results in the appearance of mental disorders. An example of such disorder is a learned helplessness. It is a state of waiting for the appearance of the aggressor that subject cannot escape and which is unpredictable. The inability to cope with

such a strong stress causes apathy and passivity, as well as symptoms of depression [Gillham 2000]. In the extensive system of breeding pigs, cannibalistic behaviour hardly ever occurs, that is why these reactions are considered abnormal. One of the examples of such abnormal behaviour is chewing or biting tails. Currently, there are three types of this phenomenon in the case of pigs: two-stage – due to boredom; sudden and forced biting – due to frustration; obsessive.

Two-stage type of biting tails is based on initial holding the tail of a other subject in the mouth cavity without damaging it. This refers to the exploratory behaviour of pigs that try to ”explore” a new element of the environment. In the second phase of this behaviour the skin is damaged and starts to bleed, which further stimulates cannibalistic behaviour of other individuals. In the case of the second type, i.e. a sudden and forced biting, there is no stage of exploration. Pigs due to the frustration at the limited access to food or water, start biting the tails of other individuals. The third type is obsessive. It is characteristic for the animals, which in the early stages of development grew more slowly [Temple *et. al.* 2011]. In order to prevent cannibalistic behaviour docking of pigs' tails is used. However, this method raises a lot of controversy so the attention absorbing materials are becoming increasingly popular.

REPRODUCTIVE BEHAVIOUR

Under the influence of changes taking place in the body during heat, there are changes in the external genital organs. Vulva is swollen, mucous membranes pink and vaginal mucus comes with a slight admixture of blood. Sow's behaviour also changes. Initially, the female loses appetite, is energised, perks up own ears and tries to climb over other females. Sows that are “warming up” make mild and low-pitched grunts – they “hum” at each other [Hulsen and Scheepens 2014]. The female during heat, in the presence of the male, sniffs around his head and genitals but also urinates frequently. At the time of the so-called “gesture of tolerance”, mating can occur. The calm behaviour of the female during mating is caused by, among others, peculiar smell of boar (pheromones). Boars' sexual drive is permanent and intensifies in the presence of the sow during heat. Boar, before mating, stimulates sow by jostling her with a snout in the flanks area and puts his head on her haunch. Sexually active boar grinds his teeth, foams, emits a distinctive smell from the glands that are located at the forelegs and the foreskin. It also emits a low-pitched distinctive sound [Grudniewska 1995].

MATERNAL BEHAVIOUR

The signals of the impending birth include, among others, frequent urination, preparing the nest and visible signs of an anxiety. The labour is often associated with aggressive behaviour It is a reaction to the stress caused by pain and a potential threat to newborn piglets [Hulsen and Scheepens 2014]. Sows that are more aggressive in the delivery room are later more protective and caring to their offspring, than the mild females [Faucitano and Schaefer 2008]. A birth starts with the phase of dilation of the cervix. At this stage, a sow is particularly anxious and starts to prepare a den for the offspring. In the

next phase, which is a phase of displacement of the fetus, the female lays on its side and in this position it usually ends the labour. Sow signals feeding through low-pitched sounds. When she lays on a side, she encourages piglets to suck. The aggression can be redirected to offspring, as it often happens in the case of sows. Sometimes a phenomenon called filial cannibalism may occur. It is devouring own offspring by the young mother. The reasons for such behaviour are associated with the nutritional deficiencies, reactions to stress or psychiatric disorders resulting from an inadequate rearing [Grudniewska 1995]. The research was conducted on the impact of the gilts' date of transfer to farrowing pens on the behaviour during childbirth. In the studies of Pederson and Jensen [2008] it was proved that sows that were moved to farrowing pens at a later date, at labour were restless and showed no signs of species-typical maternal behaviour.

LOW LEVEL OF WELFARE CAUSES BEHAVIOURAL ANOMALIES

Welfare it is a condition of the subject relating to its efforts to cope with the environment. In order to measure the level of welfare four criteria were highlighted on the basis of which the evaluation proceeded: health indicators (clinical signs of disease); production indicators (decrease e.g. in daily weight gained); physiological indicators (stress hormones level); behavioural indicators (signs of pain, behavioural anomalies).

The welfare disorders occur most often in a large scale pig houses. In the case of intensive animal rearing systems, they usually have limited living space (high density of animals per area unit), which may lead to lack of freedom of movement. At the same time in such rearing conditions a monotone environment is frequently observed and what follows, it can lead to sensory deprivation. According to Empel [1992] keeping pigs in intensive farming conditions, prevents the manifestation of their natural behaviour. The animal that has no sensory stimulation begins to exhibit behaviour that is contrary to the model species and this affects the production results. The maximization of the livestock production entails a drastic reduction in the animals' quality of life. Understanding the behavioural pattern of the species enables to achieve the optimal level of welfare while improving efficiency at the same time [Kokocińska and Kaleta 2016]. A behaviour is a structure that respond to signals from the environment and from the inside of the subject and that is why the manner in which animals behave is a perfect reflection of the living conditions. The result of the lower welfare level is an increase in stress reactions and related behavioural aberrations (including self narcotizing). Excessive animal exposure to the stress factors results in decreased immunity and an increase in falls of animals. Consequently, the reduction in the profitability of production is observed [Frind *et. al.* 2006]. Keeping pigs on litter provides the animals to have an opportunity to express natural behaviour. A clean and dry straw stimulates animals to explore, is suitable for eating, chewing, digging and can be destroyed. The more there is, the higher is the frequency of exploratory behaviour. In the current conditions of large scale rearing, where slatted floor system of maintenance prevails, the use of the straw as part of manipulative materials is not possible. Due to that an alternative measures to improve welfare should be searched for.

BEHAVIOURAL WELFARE INDICATORS

Behavioural anomalies, are comportments that deviate from the model species. Among the anomalies that occur to pigs, some can be distinguished: motor anomalies – hitting head on the elements of the pen; oral anomalies – licking and biting the sides of the body; cannibalism – biting the tails and ears, biting piglets by the sow.

A specific type of behavioural anomalies are stereotypies. These are simple acts that are ritualized, repetitive and do not have to conduct any meaning in terms of meeting the physiological needs of the body. This applies from 20% up to 100% of the animals that live in the industry breeding conditions [Pejsak 2007]. Depending on the intensity, stereotypies are divided into advanced pathoetiologies (injuries) and low pathoetiologies (deviations from the standard species does not lead to injury). The main cause of pathological behaviours is abnormal animal welfare. The first noticeable symptoms of reduced welfare are declined productivity and deterioration of animal's condition. Only then the attention is drawn to the presence of stereotypies, which is a big mistake, because behaviour is an important indicator of the quality of animals life.

Self narcotizing is a kind of an addiction to β-endorphin secreted by the brain. It most often happens to animals which live in the place of limited freedom. Following a prolonged stress stimulus (sensory deprivation, restriction of freedom) a release of the opioid (β-endorphin) may occur. It leads to the situation in which an animal feels enjoyment. It is a defensive reaction, which protects the body from psychosomatic disorders. Another important behaviour disorder is transferred behaviour, which is manifested by pigs primarily by biting the tails and ears. The animal that is unable to satisfy the instinct of digging and chewing starts to look for "alternative" objects [Mroczek 2013].

ENRICHMENT

The term enrichment is used to describe changes of the animals' environment, in order to improve living conditions by enabling them to express natural behaviour. Nowadays, most of the rearing systems do not allow the manifestation of behaviour that is consistent with the pattern of the species, which leads to behavioural problems. In order to reduce the occurrence of undesirable behaviour and minimize pigs aggression, it is advisable to enrich the environment through modification such as:

– physical – changing the complexity of the environment,
– social – enabling contact with other individuals of their species or a human,
– class – the use of manipulative materials that encourage animal activity,
– food – changing the way of feeding,
– sensory – affect on the sense organs of animals.

The introduction of new elements has a positive effect on the use value and the health of the animals, which consequently leads to increased profitability of production. The use of attention absorbing materials, makes pigs less aggressive towards the changes in their environment and causes them to be less problematic in rearing [Kittawornrat and Zimmerman 2010].

Methods of environmental enrichment

One of the most effective ways to prevent boredom in the case of pigs is the use of so-called manipulative materials i.e. toys. In studies by Nowicki *et al.* [2007] it was proved that the components which undergo deformation or destruction are more attractive for pigs and help to establish the hierarchy. When choosing the right material which allows the animals to express cognitive behaviour, breeders and producers should have the knowledge about the behavioural pattern of the species. By using the knowledge on how pigs receive stimuli from the environment, standard features toys were set i.e. edibility, safeness, encouragement to contact, the potential to be chewed [Nowicki *et al.* 2015].

Pigs most developed senses are the sense of taste and smell. By stimulating these senses, one can get the attention of the animal and that is why the toy should have an appealing taste, fragrance and nutritional factors [Korniewicz 2012]. It is unacceptable that supplied components would contain harsh elements, such as wires and splinters of soft trees (e.g. Pine). The presence of these elements can cause serious bodily injury and intestinal perforation. It is important that toys were made of non-toxic materials that allow to keep them clean, because pigs lose interest in contaminated elements [Tynes 2015]. Objects placed directly on the ground are more interesting to pigs than the objects placed somewhere above. The instinctive manifestation of pigs' behaviour is chewing, so it is important to provide attention absorbing items which give the possibility of its implementation [Karpiesiuk 2013].

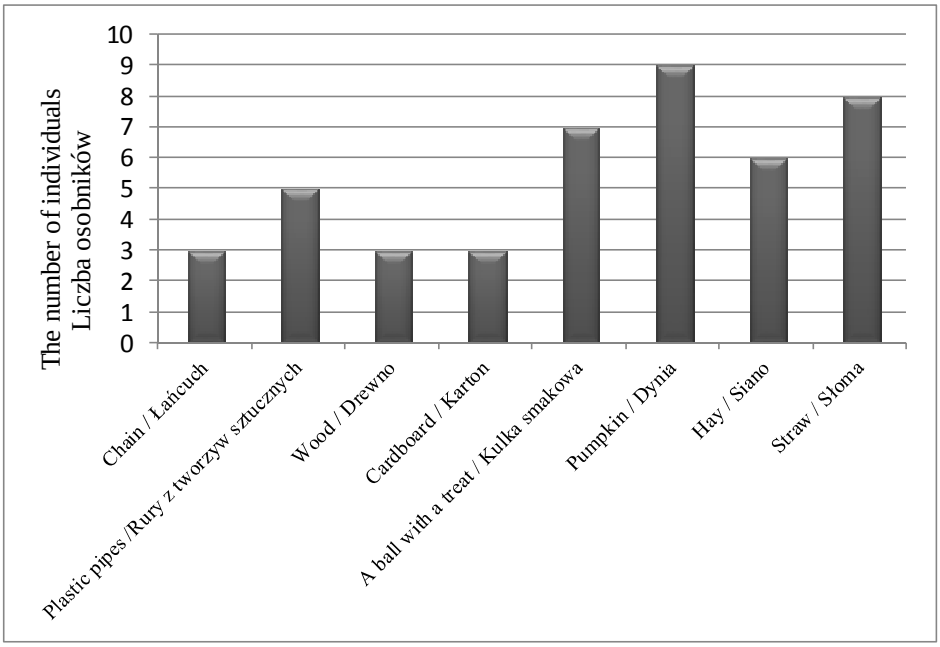

Fig. 1. Number of pigs interested in individual manipulative elements (on the basis of own work)
Rys. 1. Liczba świń zainteresowanych poszczególnymi elementami manipulacyjnymi (na podstawie badań własnych)

The preferences of pigs were verified during own experience. The animals were kept in the non-litter system. The porkers received feed which covered daily energy requirements and was not changed during the whole period of the experiment. Observations were performed on a group of 10 animals with a body weight of approx. 50 kg, over a period of eight days. Every day the animals were getting other manipulative element: chain, plastic pipes, wood, cardboard, ball with a treat, straw, hay and pumpkin. During the experiment the level of interest in particular toys was observed. Only those subjects were taken into account which showed an interest in test bodies after 45 minutes after installation of them in the pen (fig. 1).

The enrichment of the environment with these elements, encourages the animals to explore it in two ways: by internal development (the possibility to manifest behaviour is a rewarding value) and external development (finding hidden food is a reward for the behaviour) [Kaleta 2007]. The experience Department of Pig Breeding and Production Technology of University of Life Sciences in Lublin has shown that pigs were mostly interested in exploratory materials that were suitable for consumption – such as pumpkin or straw. The low interest in inedible materials has occurred probably due to a slight strengthening of reaction to these elements. Pigs prefer edible toys that have the taste and smell.

CONCLUSIONS

The knowledge about the behaviour of pigs allows to obtain the satisfactory production results and is essential for the rearing and breeding of pigs. The way animals behave is a reflection of the conditions of their keeping. Limiting the possibility of satisfying pigs' natural manifestations of behaviour, significantly reduces the level of welfare and, consequently, the production results. It leads to numerous pathological behaviours such as self narcotizing or cannibalism. In order to improve the quality of life of animals, the materials that enrich the environment should be used, to prevent the occurrence of behavioural anomalies. Pigs are mostly interested in the edible elements such as pumpkin or straw, while inedible materials do not meet the behavioural needs of pigs and that is why animals tend to lose an interest in them very quickly. When choosing the perfect toy it is crucial to have the knowledge about how pigs receive stimuli from the environment.

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Streszczenie. Celem pracy było omówienie behawioru świń i możliwości wykorzystania wiedzy o zachowaniu w praktyce hodowlanej i produkcyjnej. Szczególną uwagę zwrócono na zależności pomiędzy dobrostanem a behawiorem trzody chlewnej. Jak wykazano, skutecznym sposobem zapobiegania problemom behawioralnym jest zapewnienie zwierzętom materiałów absorbujących uwagę. Stosowanie tzw. zabawek sprzyja redukcji agresji i stresu w grupie. Świnie preferują zabawki, które są jadalne, mają smak i zapach. Umiejętność odczytywania sygnałów świń w połączeniu z wiedzą o behawiorze jest ważnym narzędziem diagnostycznym pozwalającym na optymalne wykorzystanie możliwości produkcyjnych poszczególnych grup technologicznych.

Słowa klucze: świnie, hodowla i chów, behawior, elementy manipulacyjne – zabawki