POLISH JOURNAL OF NATURAL SCIENCES
Abbrev.: Pol. J. Natur. Sc., Vol 27(3): 257–267, Y. 2012

BEHAVIOURAL ACTIVITY IN PIGS AT HABITUAL TEST IN RELATION TO PRODUCTION TRAITS*

***Ivan Imrich*[1], *Eva Mlyneková*[2], *Juraj Mlynek*[2], *Ludmila Mad'arová*[3], *Tomáš Kanka*[1], *Lubomíra Moravcová*[3]**

[1] Department of Veterinary Studies
[2] Department of Animal Husbandry
[3] Department of Professional Language Education
Slovak Agricultural University in Nitra

K e y w o r d s: young pig, behaviour test, feeding parameters.

A b s t r a c t

The aim of experiment was establish the relation between different behaviour activity and production results of young pigs. The observation were performed on 49 pigs of hybrid combination (Bu x La) x PIC weighing from 30 to 40 kg. It was used a twenty-minute habitual test in the one observation. During experiment were noted the following activities: number of squares that were walked through, duration of lying down, freqency of lying down and duration of standing. The animals were divided into groups for each habitual indicator separately by means of a quartile division. We monitored the following fattening indicators: average daily gains (ADG) and feed conversion ratio per one kilogram of gain (FCR). The group with the lowest number of squares walked through achieved the tendency to the highest ADG (1.038 kg) than other ones. The group with the highest number of squares walked through had tendency to the lowest FCR (2.900 kg). The group of the shorted durations of standing were achieved the tendency to highest ADG (1.065 kg) as well as to the lowest FCR (2.917 kg). Amount of lying down, the group of animals which hadn't been lying at all during the habitual test run achieved the lowest average daily gain (0.962 kg day^{-1}) and the highest fodder consumption per kilogram of gain (3.215 kg). The group of pigs with the longest time duration of lying down achieved the highest average daily gain (1.050 kg day^{-1}). The differences regarding the feeding indicators between the groups were not statistically significant. Within all the observed pigs the average daily gain significantly correlated ($P < 0.05$) with the time duration of standing ($r = -0.302$), as well as with the time duration of their lying down ($r = 0.301$).

Address: Ivan Imrich, Slovak Agricultural University in Nitra, Tr. Andreja Hlinku 2, 949 76 Nitra, Slovakia, e-mail: ivan.imrich@gmail.com

* This article has been created by the execution of the Project *Excellence Centre of the Protection and Utilization of Agrobiodiversity, the Operational Programme: 2620002 OP Research and Development, code of the ITMS project: 26220120032*, is based on the support of the Operational Programme Research and Development, funded by the European Fund for Regional Development and with the support of VEGA 1/0493/12 – Qualitative and production parameters of animal with regard to preslaughter factors, nutrition, technique and breeding technology.

ZALEŻNOŚCI MIĘDZY AKTYWNOŚCIĄ ZACHOWANIA TUCZNIKÓW W TEŚCIE ADAPTACYJNYM A ICH WYNIKAMI W TUCZU

Ivan Imrich[1], *Eva Mlyneková*[2], *Juraj Mlynek*[2], *Ludmila Mad'arová*[3], *Tomáš Kanka*[1], *Lubomíra Moravcová*[3]

[1] Katedra Nauk Weterynaryjnych
[2] Katedra Chowu Zwierząt
[3] Katedra Zawodowego Nauczania Języków Obcych
Słowacki Uniwersytet w Nitrze

S ł o w a k l u c z o w e: świnie, test adaptacyjny, wyniki tuczne.

A b s t r a c t

Badania miały na celu określenie zależności między aktywnością zachowania a wynikami produkcyjnymi młodych tuczników. Badania wykonano na 49 mieszańcach pochodzących od loch ras Białej Szlachetnej (BU) x Landrace (La) krzyżowanych z knurami PIC (Pic Improvement Company) o początkowej masie ciała 30–40 kg. Obserwacje wykonywano przez 20 minut w godzinach od 7:00 do 11:00. Komora, w której testowano zwierzęta, składała się z 16 kwadratów. Podczas badań rejestrowano następujące rodzaje zachowań: liczbę przechodzonych kwadratów w kojcu, czas leżenia, częstość kładzenia się, czas trwania w pozycji stojącej. Wyniki tuczne (od 30 do 100 kg) obejmowały cechy średniego przyrostu dziennego (ADG) oraz wykorzystania paszy na 1 kg przyrostu masy ciała (FCR). Najmniej aktywne zwierzęta, które przechodziły przez najmniejszą liczbę kwadratów, osiągały nieco większe przyrosty dzienne od pozostałych grup (średnio od 5 do 28 g). Wykorzystanie paszy na 1 kg przyrostu w grupach było zbliżone z tendencją do osiągania niższego jej zużycia przez tuczniki najaktywniejsze ruchowo. Tendencję do osiagania największych przyrostów dziennych i najniższego zużycia paszy miały tuczniki, które najkrócej stały (odpowiednio 1,065 kg/dzień i 2,917 kg/kg). Grupa, która podczas testu nie leżała w ogóle, miała najniższe przyrosty dobowe i najgorzej wykorzystywała paszę (0,962 kg i 3,215 kg/kg). Z kolei tuczniki, które najdłużej leżały, osiągały najwyższe przyrosty (1,050 kg). Jednakże wszystkie wyniki nie różniły się statystycznie. Jedynie statystycznie istotne współczynniki korelacji zanotowano między wysokością dziennych przyrostów a czasem stania (r = -0,302) oraz z czasem leżenia (r = 0,301).

Introduction

The most important types of learning are as follows: habituation and sensitization, classical conditioning, instrumental and discrimination learning, and higher forms of animal learning (KOTTFEROVÁ et al. 2008). Habituation is the simplest type of learning consisting in the fact that an animal can get used to a certain stimulus and stop responding to it if this stimulus is repeated too often. Habituation cannot be considered a sign of sensoral or muscle tiredness. It concerns the information that the memory records in relation to the insignificance and unimportance of certain stimuli or behaviour patterns. It is by negative learning which diminishes the ability to respond to a certain stimulus for a long time, whereas an animal in its central nervous system reacts quite normally to many other stimuli. This simple learning in not to respond to a certain stimulus, can be considered a kind of an adjustment by the

animal, which saves on its insignificant activities (VESELOVSKÝ 2005). The habituation phenomenon is used by the means of habituation tests in order to find out individual excitability and habituation differences in animals (KOTTFEROVÁ et al. 2008). Such a habituation test is performed in a limited space that is isolated from all sights and sounds that could be disturbing (DEBRECÉNI et al. 2010. Behavioural indicators of pigs have a certain characteristic development that is always normal for assessing their individual differences. To determine individual differences in pig behaviour, more significant values have to be provided by the excitation level (occurrence of indicators) rather than by habituation speed (decrease in indicator frequency during the test run) (NOVACKÝ and LIDAY 1996). The excitation indicators don;t remain stable in the long term if pigs are divided into individual excitable types because the reaction of pigs significantly changes as they age (from 30 kg to 90 kg) (DEBRECÉNI et al. 2010). According to CHALOUPKOVA et al. (2007) behavior of piglets before weaning did not affect behavior of fattening pigs. LORENCOVÁ et al. (2006), MLYNEK et al. (2001), observed the excitation in pigs during the habituation test, based on the motoric activities. MLYNEKOVÁ (2008) suggests to use, in case of need to differentiate between the excitation types of pigs for various experimental purposes, a twenty-minute habituation test in order to observe the following indicators of excitability: standing up, frequency of lying down, and the length of lying down at the weight of 30 kg. According to HAYNE and GONYOU (2006) for distinguishing among individuals is useful also the human approach test.

In connection with the given problem, the goal of our experiment was to evaluate the selected fattening parameters of pigs that were divided into groups with different degree of excitability, based on the observed ethological manifestations during the habituation test.

Material and Methods

The habituation observations were carried out in 49 pigs of the hybrid combination (Bu x La) x PIC with the live weight 30–40 kg in ECFA (Experimental Centre of Farm Animals). The habituation stall was isolated from the outdoor environment and had extensive lighting throughout. The habituation test is a modified test of the open field. The classical test of the open field evaluates natural behavior of an individual or a social group of animals in the open terrain. During the habituation test, an animal is observed in the bounded space, isolated from all the outdoor disturbing stimuli (in a habituation room). The one observation period was lasting 20 minutes. The floor of the habituation stall was markedly divided into 16 squares. The cameras were installed inside the room, from which the picture was

transmitted on the monitor in observation room. The observations were carried out in the morning from 7:00 to 11:00 o'clock a.m. We used the habituation test, or rather a twenty-minute modified test of the open area in our observations. The principle of the test was monitoring the various reactions to the new and unaccustomed pigs to their unknown surroundings. We were observing the following activities during the habituation test: number of squares walked through, duration of lying down, amount of lying down and duration of standing. We divided the animals into certain groups for each of the habituation indicators independently by means of the quartile division as follows (n-number of animals):

Number of squares walked through:
- P1 – a group with motoric activity < 55 squares (n = 12);
- P2 – a group with motoric activity from 55 to 102 squares (n = 26);
- P3 – a group with motoric activity > 102 squares (n = 11).

Duration of standing in s:
- P1 – a group with a standing length < 312.8 s (n = 12);
- P2 – a group with a standing length from 312.8 s to 617.52 s (n = 25);
- P3 – a group with a standing length > 617.52 s (n = 12).

Freqency of lying down:
- P1 – a group with the number of lying down < 1 (n = 7);
- P2 – a group with the number of lying down from 1 to 5 (n = 32);
- P3 – a group with the number of lying down > 5 (n = 10).

Duration of lying down in s:
- P1 – a group with the length of lying down < 150.26 s (n = 12);
- P2 – a group with the length of lying down from 150.26 s to 645.23 s (n = 25);
- P3 – a group with the length of lying down > 645.23 s (n = 12).

Within the fattening indicators of pigs, we observed the average daily gains and fodder consumption per one kg of gain of the stated weight ranged from 30 to 100 kg. Detailed mathematical/statistical data processing was realized in the statistical programe SAS version 9.1. To judge the statistically evidentiary differences between the groups, we used analysis of variance with testing of the contrasts from the Tukey (HSD) test. The Pearson coefficient index for calculating the correlation was used.

Results

There were quite significant individual differences in the observed indicators (Table 1). The variation coefficient values in the observed activities moved from 39.75% (moving through the number of squares) to 74.14% (number of lying down).

Table 1

Variation-statistical values of ethological indicators in the habituation test

(n = 49)	Number of squares	Duration of standing	Frequency of lying	Duration of lying
Min.	22.00	121.19	0.00	0.00
Max	191.00	936.20	9.00	913.37
$\bar{x}$	79.27	480.24	3.37	402.87
s	31.84	219.25	2.52	279.19
v%	39.75	45.18	74.14	68.59

Legend: n – number of animals, min. – minimum, max – maximum, $\bar{x}$ – arithmetic mean, s – standard deviation, v% – coefficient of variation

The fattening pigs divided into groups based on the number of the squares walked through showed in the figure 1. The animals which walked through the lowest number of squares during the habituation test had the tendency to the highest average daily gains (1.038 kg), while the average daily gains of the individuals with the highest motoric activity had the lowest ones (1.010 kg).

Individual pigs that had the highest number of squares walked through during the habituation test also had tendency to the lowest fodder consumption. However the differences among the groups were not statistically significant.

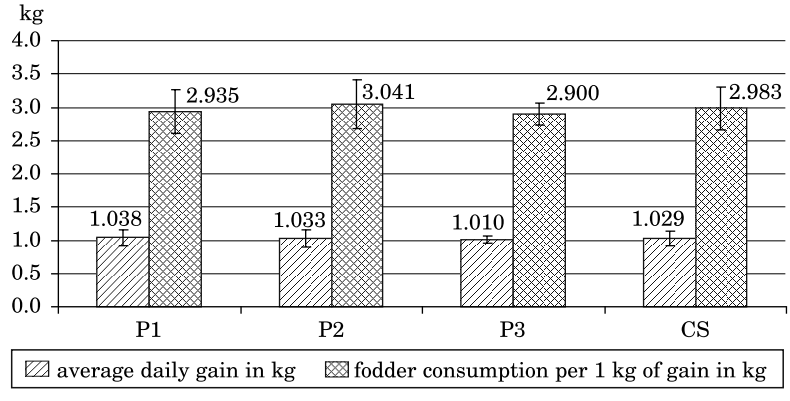

Fig. 1. Average values of the fattening indicators in the groups divided according to the number of squares walked through: P1 – the group with the number of squares walked through < 55, P2 – the group with the number of squares walked through from 55 to 102, P3 – the group with the number of squares walked through > 102, CS – together

The animals standing during the habituation test for the shortest period of time (Figure 2) achieved the highest average daily gains (1.065 kg day^{-1}), and at the same time the lowest fodder consumption per 1 kg of gain in the Test (2.917 kg). This fact can be explained in such a way that between the time

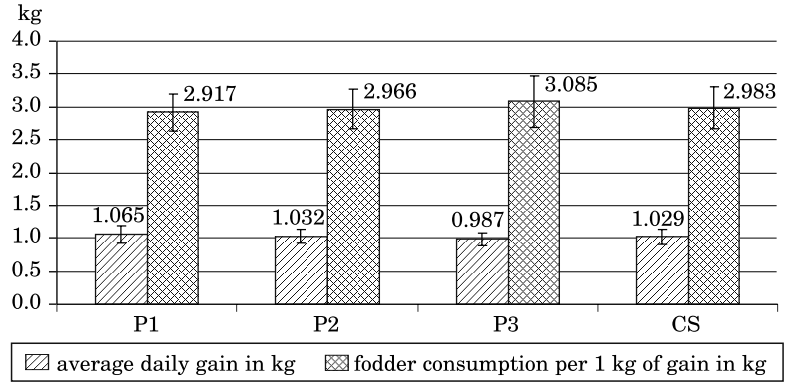

Fig. 2. Average values of the fattening parameters in the groups divided according to the duration of standing: P1 – the group with the duration of standing < 312.8 s, P2 – the group with the duration of standing from 312.8 s to 617.52 s, P3 – the group with the duration of standing > 617.52 s, CS – together

of the duration of standing and lying down there was a high negative correlation dependence (r = -0.940) – table 2, which means that individuals which were standing for a short period of time were lying for a longer period of time and could better use the received fodder for live weight formation. We haven't found out any statistically significant differences in feeding parameters among the groups divided according to the length of lying down.

Table 2

Correlation of the ethological indicators of pigs in the habituation test

Indicator	Duration of standing	Number of lying	Duration of lying
Number of squares	0.318^{+}	0.213	-0.503^{++}
Duration of standing	–	-0.497^{++}	-0.940^{++}
Frequency of lying	–	–	0.386^{++}

$^{+}$– $P < 0.05$, $^{++}$ – $P < 0.01$

It is possible to see from Figure 3 that group P2 has achieved the best fattening indicators in the animal division according to the numbers of those lying down, where it moved from 1 to 5. The group P1 represents the animals that didn't lie down at all during the habituation test. It means that the individuals reacted very sensitively to the unknown surroundings and it is very probable that they were reacting more to the stimuli of the outdoor environment during the fattening period, which had ended in worsened average daily gains (0.962 kg day^{-1}) and in the fodder consumption per kg of gain (3.215 kg).

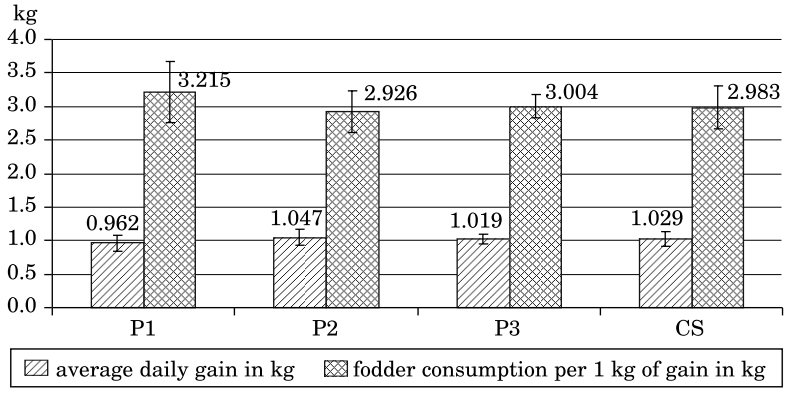

Fig. 3. Average values of the fattening parameters in the groups divided according to the number of lying down: P1 – the group with the number of lying down < 1, P2 – the group with the number of lying down from 1 to 5, P3 – the group with the number of lying down > 5, CS – together

According to the number of those lying down and to the above mentioned division, we can suppose that group P2 represents the animals with the lowest excitability, because a large number of those lying down followed by standing represented by the group P3 can also be a sign of the increased excitability of animals. We haven't found out any statistically significant differences among the groups despite the determined differences in the fattening indicators.

It suggests that the animals that had been lying during the habituation test for the longest period of time learned to react quickly to the unknown environment, which means that they habituated and adapted to the change of environment. This results in the fattening indicator value analysis (Figure 4)

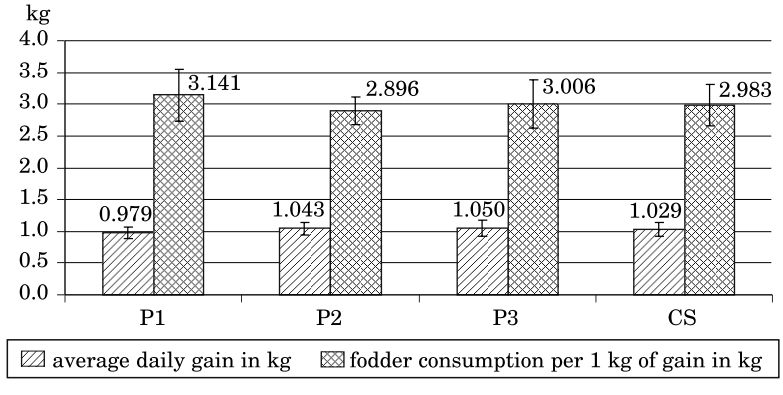

Fig. 4. Average values of the fattening results in the groups divided according to the duration of lying down: P1 – the group with the duration of lying down < 150.26 s, P2 – the group with duration of lying down from 150.26 s to 645.23 s, P3 – the group with the duration of lying down > 645.23 s, CS – together

that these individuals had the best average daily gains (1.050 kg day^{-1}) in the test. The individuals lying during the test run for shorter than 150.26 s have achieved the worst fattening indicators. The differences among the groups were not statistically significant.

The correlations from the found data during the habituation test as well as from the data relating to their fattening, which is shown in Table 3. We have found out statistically significant ($P < 0.05$) negative correlation dependence between the length of standing and the average daily gain from 30 kg to 100 kg ($r = -0.302$).

Table 3

Correlation of the ethological indicators with the fattening results of pigs

Indicator	Average daily gain	Fodder consumption per 1 kg of gain
Number of squares	-0.116	0.023
Duration of standing	-0.302^{+}	0.220
Frequency of lying	0.035	-0.133
Duration of lying	0.301^{+}	-0.120

Legend: $^{+}$ – $P < 0.05$, $^{++}$ – $P < 0.01$

The duration of standing correlated statistically significant with the number of the squares walked through ($r = 0.318$; $P < 0.05$). That's why we think that the individuals that were standing longer during the habituation test were the ones with higher excitability of the nervous system and have achieved worse results in the fattening parameters.

The duration of lying had statistically significant ($P < 0.05$) positive correlation dependence with the average daily gain during the test ($r = 0.301$). The length of lying down during the habituation test can be a kind of sign that an animal got used to the new environment, which means that it adapted to it.

It is very probable that these animals have better coped with unknown stimulus during the fattening process, as they could better get adapted to them and spend more time resting, which is a very important condition to achieve high average daily gains.

Discussion

Similar to DEBRECÉNI et al. (2010) results, in the own experiment have also used the quartile division for assessing the excitability of pigs and with regard to their production parameters into three groups. Also in this experiment the results were not statistically differentiated.

As it was mentioned in the methods the own experiment was realized at the weight of approximately 30–40 kg for the reason that animals show more activity at a lower weight. Another reason is that excitations based on ethological manifestations are more appropriate. VAN DE PERRE et al. (2011) find out most behaviour between 20 and 40 kg bodyweight of pigs and was decreasing over age. The issue of habituation tests was also dealt with by FÚSKA and BARBORÍK (2007), who observed pigs weighing between 25–30 kg and 90–100 kg. They found out that the individual pigs had been motorically more active at a lower body weight than at the weight of 90–100 kg. LORENCOVÁ et al. (2006), MLYNEK et al. (2001), MLYNEK et al. (2000), divided the animals according to the number of squares that had been walked through, which means the motoric activity, during the evaluation of the habituation tests. Like DEBRECÉNI et al. (2010), we have also used the quartile division for assessing the excitability of pigs and with regard to their production parameters, and we divided the animals into three groups.

MLYNEK et al. (2001) found out that the group with the lower motoric activity had a higher ADG (average daily gain) and lower fodder consumption per kg of gain, a higher VMP percent (valuable meaty parts) as well as a higher thigh weight. The differences of the average values among the groups were not statistically evidentiary. Nor did DEBRECÉNI et al. (2010) find out the statistically evidentiary relation of the motoric activity to the production and qualitative parameters, but they achieved higher average daily gains and lower feedstuff consumption per kg of gain in animals that showed lower motoric activity, but the difference between the groups was again not statistically evidentiary.

Comparing the feeding indicators from the view of motoric activity (number of squares walked through and the time of movement), we have found out similarly to the above mentioned authors that pigs with the lowest motoric activity had the highest average daily gains, but they did not have the lowest fodder consumption for the kg of gain. These differences were not statistically evidentiary.

MLYNEKOVÁ (2008) came to the conclusion that 30 kg animals that were lying down more times during the habituation test, achieved the highest ADG at the pre-fattening period ($P < 0.01$) as well as the consumption of the least amount of feedstuff to get kg of gain ($P < 0.01$). The animals have kept a similar tendency in ADG in the efficiency test ($P < 0.05$) and in the feedstuff consumption per kg of gain in the fattening test ($P < 0.01$).

In the own investigation the group of pigs with the low frequency of lying down from 1 to 5 (P2) achieved the highest average daily gain and the lowest feed convertion per 1 kg of body gain. The group P1 which did not lie down at all during the habituation test the worst feeding parameters were achiewed. However also these differences were not statistically significant.

Our results are a fully agree with the statements of DEBRECÉNI'S et al. (2010), MLYNEKOVA'S (2008), NOVACK'S et al. (2002), MLYNEK'S et al. (2001), JASKULKE and MANTEUFFEL (2011), that motorical activity, sound manifestations and metabolic functions (urination, defecation) observed during the habituation test can serve to identify various neuro-reflexive types. Based on the statistical analysis, we haven't succeeded to confirm a statistically important relation of the motoric activity to production parameters of pigs. On the contrary, it has found out statistically important correlations of the passive ethological manifestations (duration of lying and duration of standing) with the average daily gains.

Conclusions

The important individual differences among animals by observing the ethological manifestations during the habituation test was founded. The values of the variation coefficient had been moving from 39.75% (number of squares) to 74.14% (number of lying down). We haven't found out any statistically significant differences in the feeding parameters among animals groups. However a negative correlation dependence between the duration of standing and the average daily gain (r = -0.302; $P < 0.05$) within the whole of animals were received. Also the duration of standing was positively correlated with the number of squares walked through (r = 0.318; $P < 0.05$). It indicates that the animals which were standing during the habituation test a longer period time reacted more sensitively on the environmental change and they achieved worse fattening results. On the contrary, the length of lying down positively correlated with the average daily gain (r = 0.301; $P < 0.05$). This investigation shows also that lying down during the habituation test for the longest periods of time had similar feed convertion and achieved tendency to higher average daily gains.

Translated by LUDMILA MAD'AROVÁ

Accepted for print 16.07.2012.

References

CHALOUPKOVA H., ILLMANN G., NEUHAUSEROVA K., TOMANEK M., VALIS L. 2007. *Preweaning housing effects on behavior and physiological measures in pigs during the suckling and fattening periods*. Journal of Animal Science, 5(7): 1741–1749.

DEBRECÉNI O., MLYNEKOVÁ L., VAVRIŠÍNOVÁ K., MLYNEK J. 2010. *Influence of neuroreflexual type on the carcasses value of pigs*. Nitra: Vysoká škola pol'nohospodárska, 10–13.

FÚSKA M., BARBORÍK M. 2007. *Define the stress sensevity of pigs using habitual test.* (in Slovakian0. *XIII vedeckh konferencia s medzinhrodnou xcastou* (zborník abstraktov). Slovak Agricultural University in Nitra, 13.

HAYNE SM., GONYOU H.W. 2006. *Behavioural uniformity or diversity? Effects on behaviour and performance following regrouping in pigs*. Applied Animal Behaviour Science, 98(1–2): 28–44.

JASKULKE S., MANTEUFFEL G. 2011. *No apparent effect of an experimental narrow confinement on heart activity and cortisol in domestic pigs*. *Animal,* 5(3): 433–438.

KOTTFEROVÁ J., NOVACKÝ M., MAREKOVÁ J., HVOZDÍK A. 2008. *Veterinary etology*. Košice, Vienala s.r.o.

LORENCOVÁ V., MLYNEKOVÁ L., MLYNEK J., DEBRECÉNI, O., BOBČEK B. *Habitual pig testing*. In: *Progress of competition ability in the agriculture*, S 1. Health and the quality in the animal production. Agroregion, České Budéjovice, pp. 165–168.

MLYNEK J., DVOŘÁK J., MIGDAL W., KOVÁČ L'. BOBČEK B., BUČKO O. VAGAČ G., LIDAY I., ELIÁŠ, S. 2001. *Habitual behaviours in pigs. Chov ošípaných v 21. storočí.* Zborntk z medzinárodnej konferencie. Nitra, Slovenská pol'ohospodárska univerzita, pp. 174–178.

MLYNEK J., MIGDAL W., PAŠKa I., HALO M. 2000. *Correlation between the share of carcass parts and a pig activity in the habitual test.* Acta fytotechnica et zootechnica, Nitra SPU, 3: 106.

MLYNEKOVÁ L. 2008. *Influence of neuroreflexive type on the quality of pig's meat* (doctoral dissertation). Slovak Agricultural University in Nitra, pp. 1–102.

NOVACKÝ M., LIDAY I. 1996. *Activity CNS and a habituals as a factors which describe the individual behavior of pigs*. *Etology in the livestock production*. Zbornik referátov z vedeckej konferencie k 50. výročiu založenia katedry špeciálnej zootechniky a k životnému jubileu prof. Ing. Viktora Sidora, DrSc. 1996, Nitra: Vysoká škola pol'nohospodárska, pp. 83–85.

NOVACKÝ M., LIDAY I., POLTÁRSKY J. 2002 *Disquiet a central nervous system and the habitual false teaching of the young pigs of meat breed*. (in Slovakian). *Agriculture*, 48(5): 251–258.

VAN DE PERRE V., DRIESSEN B., VAN THIELEN J., VERBEKE G., GEERS R. 2011. *Comparison of pig behaviour when given a sequence of enrichment objects or a chain continuously*. *Animal Welfare,* 20(4): 641–649.

VESELOVSKÝ Z. 2005. *Etology. Biology in the animal production*. Praha, Academia, pp. 164.