Abstract of doctoral dissertation MSc Katarzyna Piechocka-Warzecha entitled:

"THE INFLUENCE OF STRESS TO PHYSIOLOGICAL, ETHOLOGICAL AND PRODUCTION INDEX IN RABBIT",

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Domesticated animals exhibit different degree of tolerance towards artificial environment in which they live. In big farms animals have difficulty with maintaining behavior specific to the species. Too rapid changes in the environment, promote the formation of stress that disturbs homeostasis of the organism, leading to disharmony of mental and biological processes.

Not all animals equally react to stress. The same stress situation may be fatal to an individual, while not exerting any influence on the other. In this case, the behavior of animals is the most authoritative source of information on the degree of tolerance to living conditions. Quantitative and qualitative assessment of behavioral responses deviations from the norm is an important indication as to the need to modify the technological system.

To determine the animals adapt to the environment, we can use simple behavioral tests such as "open field", SIH - stress induced hyperthermia, observation animal in indigenous cage ("hand" test) or tonic immobility.

Therefore, the rabbit's behavior in different stress situations can be associated with some features of production, the aim of the study was to obtain three groups of rabbits (20 females and 20 males), differing in their overall physical activity (hyperactive, calm and fearful) and stress reactions. After it, these animals were compared in terms of breeding performance and meat quality.

The experimental material comprised of New Zealand white rabbits breed in the number of 237 individuals from F_1 generation and 132 from F_2 generation. Rabbits from F_1 generation, based on diagnostic tests have been divided into three experimental groups. The first group (I) counted among hyperactive animals (hyperactivity not caused by fear), the second (II) - calm, confident animals, and the third (III) - fearful. In each group separated two subgroups: one to determine the reproductive performance (A

- 10 females and males) and the other for testing the quality of meat (B - 10 females and males).

To determine the allocation of animals to the group, on specific days of animal life tests were performed:

- ✓ open field – (60 and 65 day), the duration of each test was 5 minutes. Record: how long they stayed and how many moves animals done in start box, behaviour and activity after they go out the start box (defaecation, marking with secretion glands, body care, scratching the walls of the arena, attempts to jumping out of the arena, getting food from the mid-field of arena),
- ✓ tonic immobility – (70 day) measuring the time while animals were standstill on the back (in a plastic, U-shaped tray) until spontaneous return to the normal body position,
- ✓ hand test (observation in indigenous cage in the presence of a human) - (75 day), relies on the observation of the animals reaction to the experimenter touching feeder (for 3 minutes) placed inside the cage,
- ✓ SIH test – (80 day) measurement of body temperature (rectal) before and after activation of the stress factor (setting for 15 minutes in the dark, closed box), together with the measurement of the number of breaths.

To confirm the allocation of animals to the groups the level of cortisol and glucose in blood of animals were tested.

In order to evaluate production results: the percentage of covering males, the percentage of covered females, the percentage of females who gave birth to offspring, numerical productivity and body weight of offspring (postnatal and after weaning), individual body weight on certain days of rearing (35, 56, 70 and 90 day), daily body gain, and feed efficiency for 1kg of body gain were tested. The level of testosterone in the blood serum was also determined.

In the second subset, where meat quality was check, before slaughter, another stress factor was used - animals were placed for a period of one hour in a transport box, driven by on a forklift.

After the slaughter of animals at 90 days of age, slaughter analysis and dissection were performed. Analysis of meat quality was done on *musculus longissimus dorsi*. Moreover, the pH was measured 15 minutes after slaughter ($pH_{15'}$) and after 24-hour cooling at 4°C (pH_{24h}). Free water and a basic chemical composition (moisture content,

protein, fat and ash). Analysis of free water and composition in meat (water, protein, fat, ash) were performed. Additionally, a measurement of the color of the meat was determined.

In "open field" it was observed that the animals showed increased activity and quickly left the start box in the second test. They moved confidently in the area because they have a memory about the environment and explored not only extreme but middle of the arena field (habituation). In addition to the "spread" behavior pattern characteristic of most of the animals in the first test, the sequence associated with exploration: sniffing-locomotion-stand-up, repeated several times during the study period was observed.

Sixteen rabbits didn't relent to tonic immobility test (5 females and 11 males). These animals after turning on the back and the withdrawal of the experimenter's hands, immediately returned to the normal body position. Duration of tonic immobility in remaining animals ranged from six seconds to over five minutes, wherein the largest group consisted of animals in which immobility does not exceed 30 seconds (85 females and 73 males).

The animal's observation test in indigenous cage in the presence of human allowed the separation of several repeated forms of rabbit's behavior associated with the performance of the stressor. There was a sudden physical activity, which was adopted as a behavior under stress, aggression against the experimenter or other rabbits, lack of physical activity in the first minute of observation with a later attempt to take the risk and normal physical activity.

Before the SIH test, body temperature of tested rabbits ranged from 38.56 to 39.43ºC (normally body temperature in rabbit is 38.5 to 39.5ºC). After the test animal's body temperature increased and was within the range of 38.92 to 41.80ºC. Number of breaths was correlated with body temperature. At 161 individuals (58.9% - 88 female (71.5%) and 73 male (64.0%), was found increased number of breaths, and 20 of them (8.4%) (including 9 females (7.3%) and 11 male (9.6%)) had above 150 breaths per minute.

The highest level of cortisol and serum glucose, was in the fearful group of rabbits (group III), which showed no or very poor physical activity. Low or high levels of cortisol and glucose, therefore correlates with a specific behavior of the animal and way of functioning of the environment.

The low level of testosterone in the blood serum, labeled in a group of fearful males which showed no or very weak physical activity had a negative impact on the progress and results of mating. There were significant differences ($p \leq 0.01$) in the number of live-born individuals between groups IA and IIA, and IIIA, and in the average number of reared rabbits to 35 days of age, and the mean body weight of a single specimen between the group IIA and others.

The advantage of calm female line (IIA) over the other groups in terms of fertility and nurturing suggests that they were better adapted to breeding in farm conditions which do not affect the welfare of these animals.

The "open field" and SIH tests performed for the F_2 generation have shown that there is possibility to perform effective breeding selection for quantitative behavioral characteristics, if these qualities are precisely measured.

In rabbits from the group of hyperactive and quiet (IB and IIB), stress which was putting animals in the new environment (transport box raised on a forklift) was short and the animals were able to deal with it, in contrast to the fearful group (IIIB), where an additional stress factor caused the so-called the effect of summation of fear.

Body weight of rabbits after 24 hours of starvation was the highest in the IIB group (2605.2g) and the lowest in the IIIB group (2303.7g).

Active acidity values $pH_{15'}$ and pH_{24h} in groups IB and IIB were within the accepted norms for normal meat, lacking symptoms of abnormal conversion of muscle to meat. Significant differences ($p \leq 0,01$) in the protein content in the meat between the groups IB (22.8%) and IIB (23.0%), and IIIB (21.9%) were found.

The water absorption, expressed as a percentage of free water, was significantly different ($p \leq 0,01$) between the groups IB (8.61%) and IIB (8.71%), and IIIB (11.43%), which indicates less technological suitability of the meat from fearful rabbits.

It has been shown that the change of the active meat acidity (pH) measured at 15 minutes and 24 hours after slaughter changing the brightness (L*), share of red color (a*), yellow (b*), saturation of meat hue (C*) and the value of determining the percentage of free water in the meat.

The larger decrease in the active acidity of the meat after 15 minutes and 24 hours after slaughter, lower the ability to maintain of bound water and higher brightness value indicate that the meat may have, as well as meat from other species, the PSE defect.

In summary, obtained results show that observations of animal responses are an important component of the diagnosis of their welfare, and often can also be part of veterinary diagnosis of their health. Selection based on the use of behavioral tests is one of the possibilities to obtain animals with suitable temperament, which are able to transmit positive forms of behavior to their offspring.

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