THE STUDY OF THE CONDITION OF CARCASS TISSUES AND INTERNAL ORGANS OF PIGS UPON CRITICAL IMPACT OF CO_2-STUNNING

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I. INTRODUCTION

According to the practice of animal welfare, all animals intended to be used for food purposes, should be stunned (made insensible) before slaughter, so that they would not regain sensibility by the moment of death; with that, however, animal death (cardiac arrest) should not occur before the beginning of the exsanguination. The good practice of pig slaughter with the use of CO_2-stunning requires the control of the unconscious state of animals before exsanguination. In 2001, the Danish Meat Research Institute, reported the results of the scientific investigations and suggested that enterprises evaluate the unconscious state of animals by the following criteria: pigs should not have deep or regular respiration (only irregular abdominal gasping); pigs should not have intensive (except for slow) movements of legs, pigs should not show spontaneous blinking of the eye; with that, it is allowable that maximum 5% of the pigs have a corneal reflex [1]. When stunning is performed correctly, the period of insensibility of pigs caused by CO_2 should be so long that no pig would regain consciousness before cardiac arrest and loss of brain responsiveness caused by exsanguination. When stunning pigs, an increase in the CO_2 concentration higher than 70% guarantees provision of this condition. However, when the concentration of carbon dioxide is higher than 85-90%, the lethal cases can be observed (up to 8% and more of the total number of animals) [1,2]. In the practical conditions, it is a serious problem, as it is important not only to ensure the adherence to the principles of animal welfare, but also production of high quality meat suitable for long-term storage. In this connection, the investigation of the condition of pig tissues and internal organs upon the critical impact of carbon dioxide was of practical and scientific interest.

II. MATERIALS AND METHODS

The experiment was carried out in the conditions of the acting enterprise. After CO_2-stunning (during 100 s at the concentration equal to 91%) and suspending pig carcasses on the exsanguination line, the animal condition was monitored using the veterinary pulse oximeter Storm 5000 VET (Dixion, China). The sensor of the pulse oximeter was fixed on the pig ear if it had visual signs of asphyxia. In case of the absence of a pulse, the animal was tagged. Among 180 animals with the visual signs of asphyxia, 29 were tagged. The tagged pigs were suspended on the exsanguination line together with other pigs and were subjected to the operations of slaughter and primary processing according to the workflow of the enterprise. The red organs were examined to establish the tissue condition by a degree of exsanguination immediately after evisceration (in the hot condition). Before slaughtering the hot carcass weight was measured.

The tissue condition was assessed after cold treatment, which end was determined by the temperature in the depth of muscles not higher than 4 ºC. The chilled carcasses were cut and boned; with that, the fullness of the blood vessels with blood and the number of hemorrhages were evaluated paying special attention to the loin and leg.

III. RESULTS AND DISCUSSIONS

In the experiment, the medium weight of the hot carcasses was 97±11 kg. Up to 10% of pigs that did not have a pulse after stunning were the animals that gave the hot carcasses with the minimal weight (less than 85 kg); 30% gave the carcasses with the weight of 85-95 kg; 34% – 95-105 kg, 26% – 105-115 kg and 4% gave the carcasses with the weight of more than 115 kg. These results, to a greater extent, indicated individual peculiarities of pigs' perception of stunning than the relationship between the live weight and the presence of a pulse after CO_2-stunning. Therefore, the parameters of gas stunning, apparently, can be too high (fatal) for pigs with different live weight and, possibly, the result of stunning depends on stress factors before stunning and their individual effect on each animal [1].

The results of the veterinary examination of the internal organs were interpreted in the following gradation by the degree their fullness with blood. Medium degree: heart – ventricles and atria were filled with blood (blood clots), myocardium was normal or moderately filled with blood; lungs were moderately filled with blood; liver and kidneys were normal or moderately filled with blood. Higher than medium degree: heart – ventricles and atria were filled with blood (blood clots), myocardium was filled with blood; lungs were filled with blood; bronchi were normal or filled with blood; liver and kidneys were normal or filled with blood. High degree: heart – ventricles and atria were overfilled with blood clots, myocardium was significantly or strongly filled with blood; lungs and bronchi were significantly filled with blood mainly in the upper parts; liver and kidneys were significantly filled with blood.

Several carcasses (18 of 29) were characterized by the high fullness of the internal organs with blood (higher than medium and high). The medium weight of the hot carcasses, from which the internal organs with the medium degree of fullness with blood were removed, was 92±6 kg. The internal organs with higher than medium degree of fullness with blood belonged to the hot carcasses with the medium weight of 97±8 kg. The internal organs with the high degree of fullness with blood were obtained from the hot carcasses with the weight of 102±6 kg. Therefore, with an increase in the carcass weight, the risk of production of the most valuable by-products having low quality also increased.

Almost all selected carcasses after chilling were assessed as having the high degree of tissue fullness with blood. The condition of only one carcass can be characterized as a degree of fullness with blood higher than medium (blood in the knee joint was not observed; however, the large blood vessels of the leg were filled with blood). With that, under the high degree of fullness with blood, the following condition of the carcass tissues was meant: the skin of the leg had the strongly pronounced network of the thrombotic blood vessels filled with blood, in several places with hemorrhages (hematomas); the knee joint and internal large vessels of the leg were filled with blood in a significant amount; the muscular tissue adjacent to the joint was soaked with blood; back fat and mid-back fat were stained with blood, the blood vessels in back fat and mid-back fat were with blood, in several places back fat and mid-back fat had punctate hemorrhages and hematomas; blood clots were observed along the vertebral column, the vertebral bones along the splitting line were soaked with blood; the presence of blood in the blood vessels of the belly was noticed. On the cross-section of M. Longissimus dorsi, punctate hemorrhages were observed. In the leg, the sections of muscles with fibers that were heterogeneous in terms of color (from dark to pale pink) were observed, the visual structure of fibers was coarse and enlarged as a result of the contraction.

IV. CONCLUSIONS

The presented results are only a part of the large research, which aim is an assessment of pork carcass quality when using CO_2-stunning in the Russian enterprises. As the first results showed, the absence of a pulse after gas stunning led to production of poorly exsanguinated carcasses and by-products, negatively affected appearance and commercial quality of products. Poor exsanguination is a cause of increased microbiological risks. Therefore, the presented study confirms once more that exsanguination should be started when the heart is working, and in addition to controlling the signs of the unconscious condition of animals, monitoring of the signs of breathing and heartbeat is required.

ACKNOWLEDGMENT

The V.M. Gorbatov Federal Research Center for Food Systems of Russian Academy of Sciences thanks the enterprises that actively participate in the organization of the investigations of the processes of slaughter and primary animal processing.

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