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THE INFLUENCE OF THE CASTRATION METHOD ON MEAT CUTS INDICATORS OF PIG CARCASSES

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Abstract

In order to determine the influence of the castration method on the indicators of the meat cuts of pig carcasses, two groups of 74 boars were selected. Surgical castration was carried out in one of them, and immunological vaccination method was used in the other group. Both surgically castrated and immunocastrated boars were reared and fattened under the same conditions. And at the end of fattening, they were slaughtered and their carcasses evaluated for weight and proportion of meat cuts separately in the cervical-scapular, back-lumbar and pelvic-femoral thirds. The result of the assessment was the establishment of a significantly higher value of the weight indicators of such meat cuts as single-grade pork from the neck by 0.3 kg or 20.0% (P <0.01) and the weight of lard with skin by 0.6 kg or 13.64 % (P <0.05) in the shoulder-scapular third of the carcass and single-grade pork per 0.2 kg or 15.38% (P <0.05) in the pelvic-femoral third of the carcass in immunocastrated pigs. A significant difference in the weight and content of other meat cuts of carcasses was not established with the use of immuno- and surgical castration of pigs.

Key words**:** *immunocastration, surgical castration, neck meat, brisket, loin, belly*

INTRODUCTION

Besides the influence of the pre-slaughtering live weight, castration is another factor with a deep influence on the pork quality [31]. In order to improve the taste qualities of pork, boars are castrated, which is a common component of the production of high-quality meat products in the world. However, recent trends in the humanization of the production process of the use of animals in agriculture require such an organization that minimizes the suffering and pain of pigs and their cruel treatment. The essence of castration comes down to stopping the functioning of the gonads [15] and preventing the accumulation of skatole and androstenol in fatty tissues and muscle bundles, which are the cause of unpleasant taste and specific smell [3]. The traditional method of pig castration is

surgical. Physical or surgical castration of boars is currently still a common practice to reduce the appearance of boar taint in male pigs [13], although it is increasingly criticized for its negative impact on pig welfare [4]. In addition to the common method of surgical castration of boars [36], various countries use such methods as artificial reduction of the activity of the hypothalamic-pituitary-gonadal axis [14, 38], local destruction of testicles with chemical components [40], as well as immunocastration [6, 33]. Immunocastration is a way to ensure both high quality products and a high level of animal welfare [22]. However, this method of castration is not universally accepted. In many countries, it has either not yet spread due to the low development of technology in the pig industry, or due to the fears of farmers and consumers about the negative consequences for human health from the consumption of meat products from immunocastrated pigs, which is associated with a lack of information [24].

Surgical castration is a cheaper veterinary procedure compared to immunological castration, and does not require an expensive special vaccine, injection equipment, monitoring of piglets for subcutaneous reaction and repeated twice labor-intensive manipulation [20]. However, surgically castrated males typically consume 10-15% more feed compared to immunocastrated males to produce the same amount of pork [26], which minimizes the cost of surgical castration. And the subsequent higher feed efficiency of immunocastrated boars compared to surgically castrated ones can offset the higher costs of immunological castration of pigs [10].

It has been established that immunocastration as an alternative to surgical castration has a number of advantages and disadvantages. It was found that the disadvantage of surgical castration consists in a noticeable increase in feed costs [8] and higher carcass fat content[17], the risk of bleeding, the development of suppuration of the wound and the formation of hernias after surgical intervention. The use of immunocastration improves both consumption and assimilation of feed, increasing meat content,the area of the back longest muscle, the protein content in the meat and a decrease in the fat content and the thickness of lard [35]. Similar data on a higher calculated percentage of lean meat at approximately the same carcass weight in immunocastrates compared to surgically castrated counterparts were also given in other studies [1].

As revealed in many scientific experiments, immunocastration contributes not only to a greater meat yield from boar carcasses, but also to an increase in the most valuable large-piece semi-finished products. In particular, other comparisons of immunocastrates with surgical castrates show their advantages in terms of carcass quality (less carcass fat, heavier leg and shoulder) [11]. It was established that the carcasses of immunocastrated pigs differed from the carcasses of surgically castrated pigs by higher carcass weight [25], longer carcass length and length of the bacon half, and lower bacon thickness at all measurement points [29]. In addition, scientists also report better carcass quality from immunocastrated pigs due to increased meat content, reduced boneless shoulder fat and leg fat, as well as reduced total fat and skin content [16]. There are reports that the use of immunocastration in boars leads not only to a decrease in fatness of carcasses, but also to an improvement in growth, compared to the effect of surgical castration [27]. In published similar data, we found that during the period of fattening, the best average daily gain was distinguished by immunocastrated pigs, which consumed 0.09 or 2.8% less feed per kilogram of gain compared to uncastrated pigs and by 11.4% compared to surgical castrates [30].

There are studies that do not confirm the positive effect of immunological castration either on the parameters of carcasses or on the indicators of their large-piece components. In particular, it has been reported that carcass parameters and meat quality are generally not different between immunocastrated and surgically castrated boars [41]. Similarly, it was indicated that no significant difference in

the parameters of carcasses and their parts was found between surgically and immunocastrated pigs [39]. For example, pig carcasses with both methods of castration did not differ in length and the length of the bacon half [9].

Moreover, some authors also note the negative impact of immunological castration on the slaughter performance of pigs. In particular, the results of scientific works indicated that immunocastration led to increased fat deposition, although it did not affect the parameters of muscle mass [37]. At the same time, it became known that immunologically castrated pigs lost an average of 0.7% more live weight during transportation and pre-slaughter holding than surgically castrated ones. Surgically castrated pigs had an advantage of 1.43% compared to immunologically castrated ones in terms of carcass yield [7]. It has also been reported that in terms of carcass quality, immunocastrates occupy an intermediate position between surgically castrated and non-castrated pigs [5]. The percentage slaughter yield of immunocastrates compared to surgical castrates was lower, indicating higher economic losses in pork production using immunocastration compared to the surgical castration baseline [32]. In support of such data, a conclusion was found that immunocastrates are economically less profitable for pork production than surgically castrated pigs [21]. It has also been reported that immunocastrated pigs showed more aggressive social activity before receiving the second dose of vaccine compared to surgically castrated counterparts, but their behavior leveled off after revaccination [34].

Therefore, taking into account the diverse views of scientists regarding the effectiveness of using immunocastration of pigs to improve production and increase slaughter qualities, its research is relevant. In this regard, the goal of our work is to study the influence of the castration method on the meat cuts indicators of pig carcases.

MATERIALS AND METHODS

The research material was hybrid pigs obtained from a combination of crossbred Great White and Landrace sows with boars of the Maxgro synthetic line of Irish origin, raised in the conditions of Globinsky Pig Complex LLC, Poltava region, Ukraine, and the object of research was their slaughter qualities, namely, high weight-pieces of carcass meat cuts. Two pairs of normally developed sows, close in weight, numbered with red and blue tags with individual numbers, were selected for research during the farrowing period of sows, and weighed individually.

Pigs of the first (control) group in the number of 74 heads marked with red tags were surgically castrated on the same day, and boars of the second (experimental) group also in the number of 74 heads marked with blue tags were left uncastrated for their further immunological castration with Improvac Boar Taint Vaccine (Zoetis, South Africa).

Six days after being put on fattening at the age of 77 days, uncastrated piglets were injected with the Improvac vaccine in a dose of 2 ml. Repeated vaccination with the same vaccine was carried out on the 125th day of life in a dose of 2 ml. At the end of fattening, all animals after a 24-hour waiting period were individually weighed with a fixation of the weight on the animal's back, after which 30 heads weighing close to 100 kg were selected from each group and sent to the meat processing plant. Group I included surgically castrated animals with a live weight of 100.5 kg. The II group included immunologically castrated animals with a live weight of 100.5 kg, respectively. On the same day, the animals of both groups were slaughtered in accordance with ISO 23781:2021 [18] at Globinsky Meat Factory LLC, Poltava region, Ukraine, and their carcasses were placed in a refrigerator for intensive cooling for 24 hours. The carcasses were deboned in accordance with ISO 3100-1 [19] in the deboning unit of the slaughterhouse. During deboning and according to its results, the mass and

proportion of the most valuable large-piece parts of the carcass were evaluated.

The calculation of statistical data processing included: determination of the average value of the indicator, standard error of the value, standard deviation. The significance of the discrepancy ($p \leq 0.01$) of carcass indicators of different groups (n = 30) was determined using the Student's t-test. The indicated statistical calculations were performed using Microsoft Office Excel 2010.

The feeding, castration and other manipulations of the pigs in the study were humane and did not cause pain or cruelty and met the requirements of Council Directive 86/609/EEC [12]. The methodological part of the experiment was approved by the Bioethical Commissions of Animal Care and Use during scientific (experimental) research of Sumy National Agrarian University (ethical approval number BT-22-0122-05).

RESULTS AND DISCUSSIONS

The evaluation of the mass of large-piece semi-finished products in the shoulder-scapula third of the carcass of experimental pigs revealed that immunocastrated pigs had a significantly higher value of the weight of neck single-grade pork from the neck by 0.3 kg or 20.0% ($p < 0.01$) and a higher value of the weight of lard with skin by 0.6 kg or 13.64% ($p < 0.05$). According to such parts of the carcass as the neck with the bone, meat from the neck, meat from the shoulder blade, single-grade pork from the shoulder blade in the shoulder-scapula third of the carcass between surgically and immunocastrated animals, there was no probable difference (Table 1).

According to the share of the main large-piece semi-finished products in the shoulder-scapula third (Fig. 1), a slight advantage of immunological castrates was established in terms of the content of neck with bone, neck meat, neck single-grade pork, shoulder blade meat without bone, and a significantly lower lard content in it.

Table 1. Mass of large-piece semi-finished products in the shoulder-scapulathird of the carcass, n=30

Indicator	Group I	Group II
Mass of the shoulder-scapular third, kg	25.0±1.41	25.3±1.38
Neck with bone, kg	8.2±0.46	8.6±0.49
Neck meat, kg	4.4±0.24	4.6±0.20
Neck bone, kg	2.3±0.15	2.1±0.21
Neck single grade pork, kg	1.5±0.07	1.8±0.08[2]
Shoulder blade meat, kg	8.6±0.48	9.1±0.55
Shoulder bone, kg	1.9±0.10	2.2±0.26
Shoulder single grade pork, kg	1.9±0.12	2.1±0.12
Lard with skin, kg	4.4±0.25	3.8±0.08[1]

1 – P < 0.05; 2 – P < 0.01
Source: own calculations.

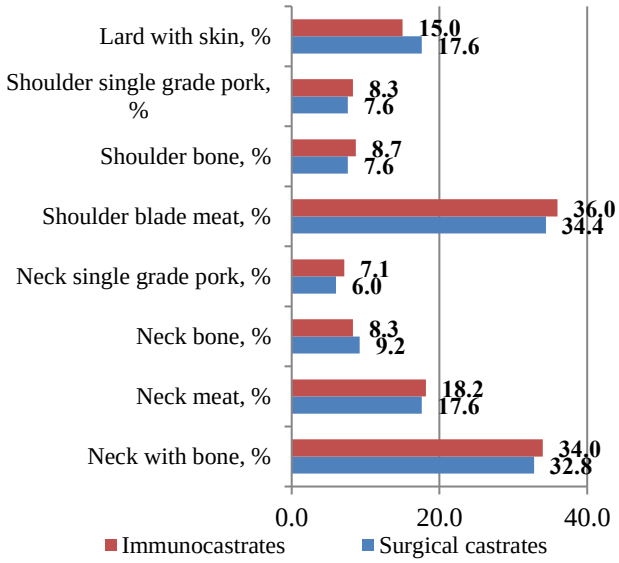

Fig. 1. Part of large-piece semi-finished products in the shoulder-scapula third of the carcass
Source: own calculations.

Table 2. Mass of large-piece semi-finished products in the back-lumbar third of the carcass, n=30

Indicator	Group I	Group II
Mass ofback-lumbar third, kg	26.6±1.82	26.4±1.74
Loin bone-in, kg	12.1±0.76	12.3±0.93
Belly bone-in, kg	14.4±1.06	14.1±0.81
Eye of loin, kg	5.9±0.26	5.9±0.37
Bone of loin, kg	2.2±0.04	2.4±0.12
Belly, kg	12.4±0.99	11.9±0.73
Bone of belly, kg	2.0±0.04	2.1±0.06
Single grade meat, kg	0.4±0.03	0.4±0.03
Spine lard with skin, kg	3.7±0.48	3.6±0.43

Source: own calculations.

When analyzing the mass of large-piece semi-finished products in the back-lumbar third of the carcass (Table 2), no significant difference

was found in pigs with both types of castration.

Analyzing the share of the main large-piece semi-finished products in the back-lumbar third of the carcass (Fig. 2), an increase in the content of pork belly in the carcass of immunocastrated animals was established. At the same time, the content of brisket and lard was higher in surgically castrated pigs.

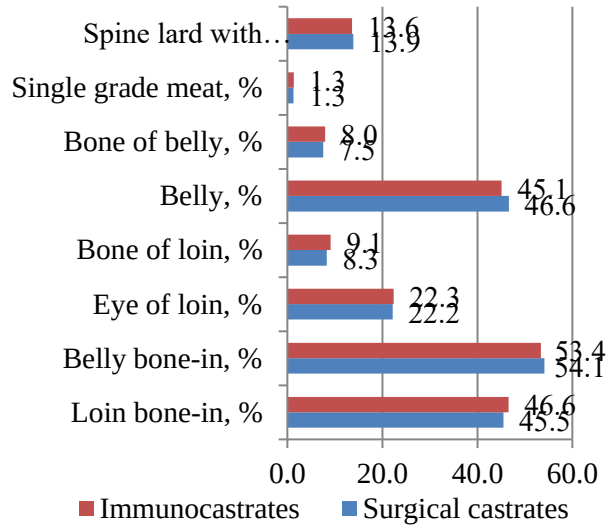

Fig. 2. The share of large-piece semi-finished products in the back-lumbar third of the carcass
Source: own calculations.

In the pelvic-femoral part of the carcass, an increase in the mass of single-grade pork was observed by 0.2 kg or 15.38% ($p < 0.05$) in immunocastrated pigs. The method of castration had no effect on the weight of leg boneless and fat pork with skin (Table 3).

Table 3. Mass of large-piece semi-finished products in the pelvic-femoral third of the carcass, n=30

Indicator	Group I	Group II
Mass of pelvic-femoral third, kg	26.9±1.52	26.8±1.50
Leg boneless, kg	17.6±0.88	17.4±1.18
Bone of Leg, kg	2.5±0.13	2.6±0.11
Tail, kg	0.4±0.02	0.4±0.01
Single grade pork, kg	1.3±0.07	1.5±0.04[1]
Fat pork with skin, kg	5.1±0.44	5.0±0.16

1 – $P < 0.05$
Source: own calculations.

Analyzing the proportion of large-piece semi-finished products in the pelvic-femoral part of the carcass (Fig. 3), an increase in the proportion of the leg boneless and an increase in the proportion of fatty pork with skin in the carcasses of surgical castrates compared to the carcasses of animals castrated with the help of the Improvak vaccine was found.

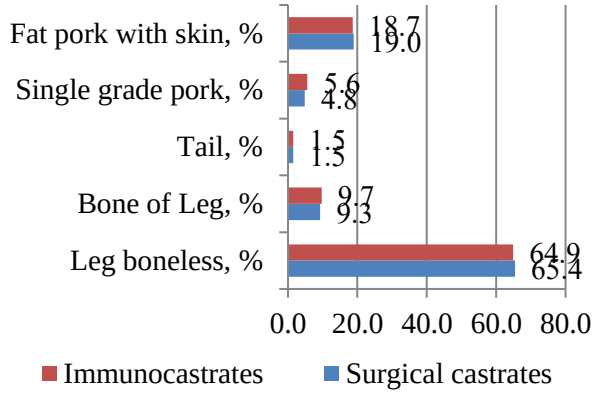

Fig. 3. The share of large-piece semi-finished products in the pelvic-femoral third of the carcass
Source: own calculations.

Thus, in general, the difference in the most valuable large-piece parts of the carcass in immuno- and surgically castrated pigs was minimal. Our results do not coincide with published data on the difference in carcass parts for different methods of castration. Thus, the authors found that in the carcasses of immunocastrated pigs, there is a tendency to increase the proportion of eye of loin in them by 0.44%. However, we did not find a significant difference in this indicator in pigs of both groups [2].

Also, our study did not confirm reports that immunocastrated male pigs showed greater weight of large meat cuts such as hindshank ($P<0.05$), as well as shoulder boneless and leg cuts ($P<0.05$), compared with a control group of surgically castrated boars. We can state a lower amount of lard in surgically castrated pigs in our experiment, similar to data [23], which indicate similar results, where surgically castrated pigs had less lard ($P <0.05$) compared to immunocastrated counterparts, which resulted in meat semi-finished products with a lower amount of fat and, therefore, with a higher yield of meat.

Our data contradict the results of the research of other authors [28], the evaluation of the yield of large-piece semi-finished products proved the superiority of the carcasses of immunocastrated pigs.

So, it is indicated that the tenderloin was heavier by 0.16%, the neck by 0.38%, the eye of loin by 0.68%, the leg boneless by 1.98%. In general, the advantage of the group of immunocastrated pigs over the surgically castrated ones in the content of the most valuable large-piece semi-finished products was 3.20%.

We did not obtain a reliable difference in the weight of the indicated large-piece semi-finished products for the use of immunological and surgical castration.

We did not obtain similar results with the data [11] on heavier leg boneless and shoulder blades in immunocastrated pigs, and the indicated meat cuts in our study were the same for pig carcasses with both castration methods.

Also, our finding of 0.6 kg or 13.64% ($P < 0.05$) higher lard and skin content in immunocastrated pigs directly contradicts the results [16], which indicated a positive effect of immunocastration on lard content and skin in carcasses compared to the effect of the surgical method.

Basically, our findings coincided with the statements [38, 40] that no significant difference in the parameters of carcasses and their parts was found between surgically and immunocastrated pigs.

CONCLUSIONS

Compared to surgically castrated pigs, immunocastrated pigs showed a higher value of the weight of neck single-grade porkby 0.3 kg or 20.0% ($p < 0.01$) and a higher value of the weight of lard with skin by 0.6 kg or 13.64% ($p < 0.05$) in the shoulder-scapula third of the carcass and a higher value of the weight of single-grade pork by 0.2 kg or 15.38% ($p < 0.05$) in the pelvic-femoral third of the carcass.

There was no statistically significant difference in the weight and proportion of other large-piece meat cuts in all three parts of the carcass, regardless of the method of pig castration.

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