

PARTICULARITY OF SENSORY EVALUATION OF “BOAR TAIN” IN THE PORK BY CONSUMERS

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Abstract

To define the peculiarity of sensory perception of offensive smells and "boar taint" by Ukrainian consumers in samples of cooked pig meat and fat from females, surgically castrated males and immunocastrated males. The independent examination of the samples of cooked meat and fat from pigs of different gender and different methods of castration. The hybrids were received from the crossbreeding of Irish sows of Yorkshire × Landrace pig breeds and terminal boars of the "MaxGrow" synthetic line. The expertise was conducted for men and women of all ages, who consume pork. Each expert evaluated 15 samples for a qualitative level of the smell for heat-treated meat and backfat. The samples were taken from the right thoracic muscle (m. rectus thoracis) of the right half-body. The evaluation was carried out in accordance with a specially developed five-point scale, which is acceptable for non-professional tasters. It has been found that the smell of skatol can be manifest to the level of its sensory perception by a person regardless of gender and the method of pig castration. The "boar taint" was difficult for precise sensory identification, because the meat of the sexually active boars is not common in porcine production and in processing technology, so most of consumers have never smelt it before. The sample identification for meat and backfat, conducted by men, was more standardized without any particular grade differences. The women decided the samples of immune castrated boars have better smell (with an advantage of 17–22 points). The result of the Ukrainian consumers evaluation of unpleasant smells and "boar taint" detected it in pork. This smell was mainly influenced by two basic factors - the physiological features of the animal organism and the individual peculiarities of the person's perception of a smell. Women and men in different ways perceived the smells of the studied samples. The boiled meat and backfat samples smell of immune castrates was estimated by consumers higher than surgical castrates samples smell was.

Key words: pigs, immunological castration, pork, sensory evaluation, "boar taint", consumers

INTRODUCTION

The sharp, offensive smell of meat and fat of sexually active boars is a factor influencing pig production technology and consumer quality of pork. This smell is related with the physiological features of sexually active boars. “Boar taint”, according to consumers, is a defect in pig production and it requires additional costs for the production and processing of pork.

Offensive smell is mainly a sensory defect and it is not related to other pork quality characteristics. According to the research, presence of “Boar taint” is the result of the

accumulation in the body of male pigs specific substances, such as: steroids, especially androstenone (5-alpha-androst-16-en-3-one), indole and its derivatives, including the most influential scatole (3-methylindole) (Rius et al., 2011) [14].

Androstenone is an endogenous compound with a smell similar to urine. It serves as a pheromone in the process of matting boars with sows. Androstenone is produced in boar's testes. It is a metabolite of the sex hormone testosterone, and it begins to accumulate in the muscular and adipose tissues of male pigs from the beginning of their puberty. Vice versa, scatole is a product of microbial fermentation

of feed in the large intestine of boars. It has the property to be absorbed into the bloodstream, to be accumulated in the fat layers of the animal's body, and to be expressed as an smell similar to fecal or "naphthalene" (Dijksterhuis et al., 2000) [4]. The mucous membrane of the nose of the human especially sensitive perceives the unwanted "Boar taint" during the process of thermally treatment of fat, meat or pork meat products. According to the research (Jensen et al., 2014) [11], the correlation between consumer negative evaluation of pork samples and the concentration of scatole was higher than the correlation between consumer negative evaluation of pork samples and concentration of androstenone. Therefore, scatole is a more active compound in the formation of abnormal smell. However, scatole increased the perception of androstenone at high concentrations. This indicates the synergistic effect of both compounds. Other researchers (Bonnaeu et al., 2012, Font i Furnols et al., 2009) [2, 6] also indicate a high correlation between "Boar taint" and the presence of androstenone and scatole in pork samples.

The analysis of other scientific researches shows that there is a difference in the perception of "Boar taint" by consumers. Differences in the results of the estimation of abnormal smells of thermally treated meat and fat samples depend on the country, on the technology of animal production, on the breed or combination of breeds of pigs. There is also influence of some factors on the human detection of "Boar taint", such as: culinary habits and consumer preferences, methods of assessment, age, gender and level of sensitivity of people to the smell of androstenone (Font i Furnols et al., 2003, 2008) [7, 8].

Most pork consumers have a greater sensitivity to scatole smell than to androstenone smell. Scatole is identified by 99% of consumers. Some consumers acutely perceive androstenone at very low concentrations, but other consumers do not perceive it at any concentrations at the same time. According to the research about 1/3 of consumers were sensitive to androstenone, and 5 - 12% of them were classified as highly sensitive (Aaslyng et al., 2013) [1]. There is an assumption that

human sensitivity to androstenone is genetically conditioned (Keller et al., 2007) [12]. Most consumers in European countries have a high level of unacceptability of "pork with an abnormal smell" (Bonnaeu et al., 2000) [3]. Thresholds for the sensitive perception of "Boar taint" by humans are on average: for the scatole 0.20 - 0.25 µg/g, for androstenone 0.5 - 1.0 µg/g (Mortensen et al., 1986) [13].

The level of concentration of offensive smell in boar meat can be minimized by reducing the concentrations of these compounds in adipose tissue. Surgical castration, immunological castration, genetic selection, special feed additives and technological aspects of growing are measures to reduce its concentration. Currently, "humane" surgical castration using anesthesia and analgesia and an alternative method of immunological castration are the most approved practical solutions in pig production (Zamaratskaia et al., 2009) [18].

This method is based on the temporary suppression of male testicular function by reducing the release of gonadotropin (GnRF) into the blood. This suppression reduces the level of androstenone and scatole in the body (Zamaratskaia et al., 2008) [17]. Immunological castration is also more acceptable for animal welfare (Thun et al., 2006) [15]. However, the key factor of mass introduction into the production of immunological castration of boars is the normal perception and attitude of consumers to the production of such pigs. This assertion determines the economic feasibility of the "vaccination method". In many European countries, official comparative estimation of pork from animals of different genders and castration methods are carried out by various scientists (Weiler et al., 2000) [16].

In Ukraine the method of immunological castration of boars is already in use on some large pig farms. At the same time, the consumer evaluation of pig meat and fat was not carried out at the scientific and methodological level.

MATERIALS AND METHODS

During our research, we organized an independent examination of samples of

thermally treated meat and fat from pig carcasses of a commercial hybrid obtained from cross breeding sows combining Irish and Yorkshire Landrace (J×L) breeds with synthetic boars terminals «MaxGrow». Three gender groups of pigd were studied: female pigs (FE), surgically castrated boars (CM), who were surgically castrated at 2 days age, and immunologically castrated boars (IM), who were immunized with immunization Improvac®R twice: at 79 days age and at 4 weeks before slaughter. The young pigs were reared in identical conditions and were fed with full-feed compound feeds of their own production in accordance with the feeding scheme adopted on the farm. Pigs of each gender were reared separately to live weight 100-110 kg. Our research were carried out in accordance with the basic principles of working with experimental animals defined in the "European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes" (1986) and provided for by the Law of Ukraine "On the Protection of Animals against Cruelty" (2006). Random selection of five carcasses from each gender group and sampling for organoleptic estimation were completed in time 24 hours after slaughter of pigs and primary carcass treatment in rapid cooling to +2 - 4°C. Meat samples were taken from the rectum (m. Rectus thoracis) of the right hemisphere. Samples of adipose tissue were taken from adjacent layers of fat. Equally, 250 g of meat and 250 g of fat were selected from each carcass.

In laboratory conditions 5 g of muscle tissue, 5 g of adipose tissue and 5 g of distilled water were placed into glass test 45 cm³ tubes. Tubes with contents were covered with plastic lids and were placed in a water bath until the mixture was boiled. Samples, prepared by this way, were provided for organoleptic estimation by consumers. Estimation of the samples was carried out by non-professional tasters of different ages, including: 15 men and 19 women aged 22-49 years, who agreed to participate in sensory evaluation as pork consumers.

Samples were evaluated using a basic organoleptic index. This index is quality level of smell of thermally treated meat and fat. Each expert evaluated 15 encrypted samples. A specially designed five-point scale for non-professional tasters was used to estimate. Offered score had the following characteristics: 5 - excellent quality (the smell causes exceptionally pleasant sensations, encourages consumption); 4 - good quality (smell causes pleasant sensations); 3 - satisfactory quality (smell acceptable for consumption); 2 - poor quality (sample has offensive smell, with individual description); 1 - poor quality (strongly pronounced "Boar taint").

RESULTS AND DISCUSSIONS

Analysis of the organoleptic estimation results revealed a number of features that exist in the sphere of consumers sensory perception of the smell of thermally treated meat and fat of pigs of different gender groups.

It has been found that presence of offensive smell is influenced by the individual physiological features of the animal body irrespective of pigs gender and castration method (Fig. 1).

Sample 8 (pig) had the lowest score 94 points. According to consumer estimation, it received 1 point ("Boar taint") for 4 times and 2 points (offensive smell) for 9 times.

This distribution of points can be explained by the fact that scatole is the result of metabolic processes in the large intestine, where it is absorbed into the blood, and after this is deposited in the adipose tissue of the body, regardless of pigs gender. The total level of scatole in boars ranges from 0 to 0.8 mg/kg. Castrates and female pigs have lower its levels ranging from 0 to 0.3 mg/kg.

The mechanism of accumulation of scatole in pigs of different genders has not been fully studied. However, we have assumption that it may be related with differences in metabolism of boars, pigs, and castrates (Hendriks et al., 2002) [9].

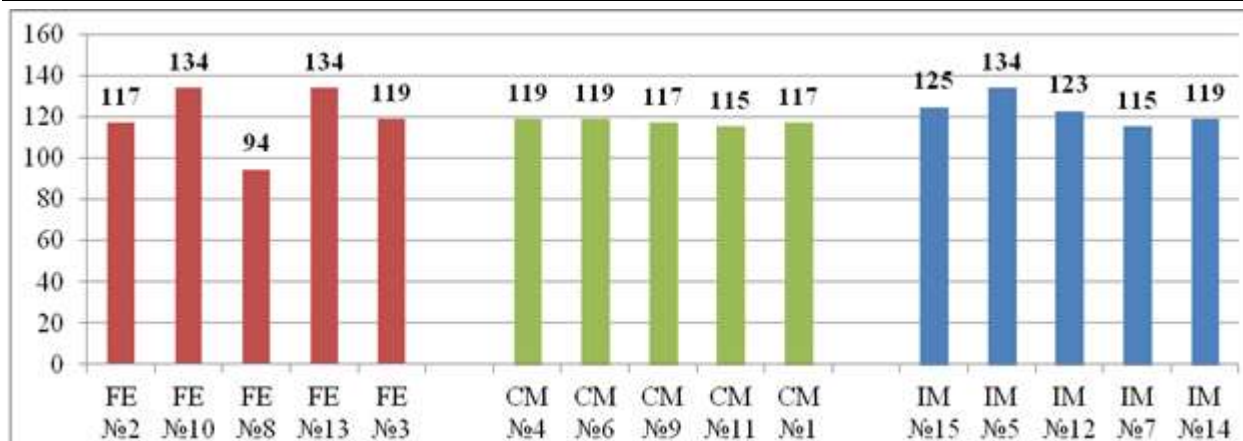


Fig. 1. Overall smell score of each tested sample, points
 Source: own calculations.

This assumption also explains the fact in our experience that different tasters have not similar result of perception and estimation of samples smell. Sometimes tasters set completely opposite scores for the same sample.

In Ukraine, meat of sexually active boars is not widely used in pork production and processing technology. Consumption of meat with "Boar taint" is limited in the consumer experience and habits, so its smell is too difficult to identify accurately. Samples 4 (surgically castrated) and 14 (immunologically castrated) received a total 119 score each, but the differences in the marks of these samples among the tasters were very large - from 1 to 5 points.

There are 1-3% of animals with a level of androstenone in adipose tissue above the norm of 0.5-1.0 mcg/g among immunologically castrated boars. This level depends on technological and physiological reasons (Dunshea et al., 2001) [5].

However, most scientists testify that the content of scatole and androstenone in immunologically castrated boars samples is lower than the threshold level of human perception of unacceptable "Boar taint".

The concentration of these substances in the tissues of surgically castrated boars is lower than the concentration of "vaccinated" boars is (Font i Furnols et al., 2008, Bonneau et al., 2000) [7, 3]. Our results also indicate that women and men perceived different smell of the studied samples (Fig. 2).

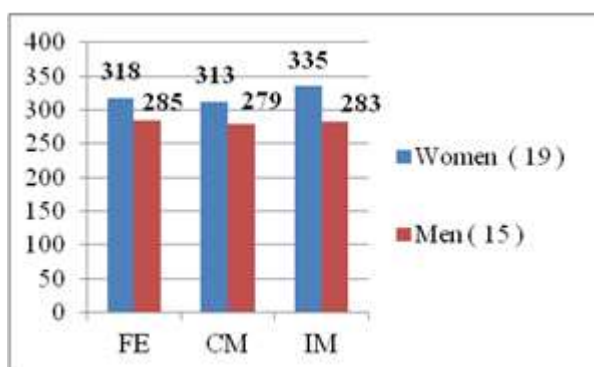


Fig. 2. Diagrams of the level of sensory evaluation of samples by women and men, points
 Source: own calculations.

In our study, the overall total score of male samples of meat and fat of pigs of different gender groups was more uniform. The difference between the groups was 2-6 points in favor of pigs. However, women indicated that immunologically castrated boars meat had comparatively better smell (with a preference of 17-22 points). It is well known, that a person's level of smell perception is genetically determined and depends on the gender of the consumer and the country or consumer preferences of the population that evaluated it. With age, human susceptibility to smell may be changed. It tends to decrease in men and increase in women (Keller et al., 2007) [12]. Our independent testing of the sensory properties of thermally treated pigs meat and fat has shown results that indicate Ukrainian consumers have not detected the unpleasant "Boar taint" in the estimated samples of immunologically castrated boars compared to the samples of female pigs and surgically castrated boars (Fig. 3).

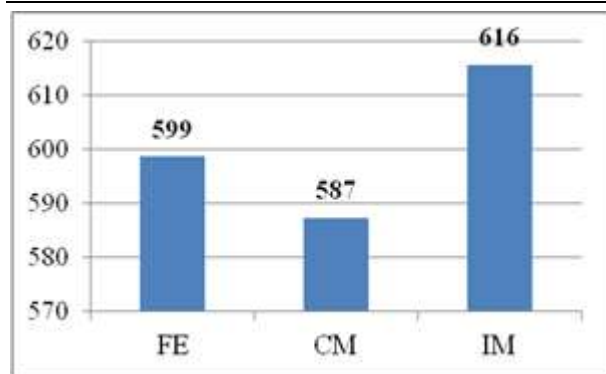


Fig. 3. Total distribution results of sensory evaluation thermally treated meat and fat samples of different gender pigs groups, points
Source: own calculations.

This result is consistent with the data of other researchers (Bonnaeu et al., 2012, Hennessy et al., 2006) [2, 10].

CONCLUSIONS

Comparative evaluation of thermally treated meat and fat samples of different gender pigs and castration methods revealed some peculiarities of sensory perception of "Boar taint" by Ukrainian consumers.

The physiological characteristics of an animal's body and the individual characteristics of a person's odor perception are two basic factors influencing consumer's assessment results of the offensive smell.

The smell of thermally treated meat and fat samples of immunologically castrated boars was estimated higher than this indicator of female pigs and surgically castrated boars.

For a fuller understanding the peculiarities of unpleasant "smell of boar" perception in pork according to the taste preferences of Ukrainian consumers, it is advisable to conduct a series of studies in different regions of Ukraine.

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