PE7.07 Impact of consumers' sensitivity to androstenone on acceptability of meat from male pigs vaccinated with Improvac® 88.00

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***Abstract*— The aim of this work was to evaluate sensory acceptability of meat from male pigs vaccinated with Improvac to Spanish consumers according to their sensitivity to androstenone. Twenty loins from entire male (EM), surgically castrated male (CM), Improvac vaccinated male (IM) and female (FE) Piétrain x (Duroc x Landrace) crossbreds totalling 80 loins were used. Loins were cut into 1.5 cm-thick pieces and cooked in a pre-heated oven at 180ºC for 10 minutes. Odour and flavour acceptability was evaluated by 201 consumers in 20 sessions using a 9-point category scale. Sensitivity of consumers to androstenone was evaluated by smelling pure androstenone. The SAS Proc Freq and Proc Mixed procedures were used for data analysis including type of meat as a fixed effect, session as a blocking variable and consumer as random effect. Forty-five per cent of consumers were classified as sensitive to androstenone. Odour and flavour scores were significantly lower for EM than CM, IM and FE for all the consumers combined. However, less sensitive-insensitive consumers did not find significant differences between types of meat. It can be concluded that meat from IM is accepted by consumers at the same level as meat from FE and CM but when only less sensitive-insensitive consumers were considered there were no differences of acceptability between any type of meat.**

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***Index Terms*—androstenone sensitivity, boar taint, consumer acceptability, immunocastration, Improvac, vaccination**

I. INTRODUCTION

BOAR taint is an unpleasant sensory defect of meat, mainly from entire male pigs due mainly to androstenone and skatole. Surgical castration without anaesthesia of male piglets is the most common technique to reduce boar taint in the majority of the European countries [1], but it is painful and stressful for the pigs [2]. Recently, vaccination against gonadotrophin-releasing factor (GnRF) (also known as immunocastration) has appeared as a more welfare-friendly alternative to surgical castration [3]. Immunization against GnRF suppresses testicular function and reduces levels of androstenone and skatole to levels comparable to those found in surgical castrates [4][5].

Boar taint affects consumers' acceptability of pork meat [6] and acceptability is also dependent on the sensitivity of consumers to androstenone [7][8].

The aim of this work was to evaluate sensory acceptability of meat from male pigs vaccinated against GnRF to Spanish consumers depending on their sensitivity to androstenone.

II. MATERIALS AND METHODS

The methodology has already been described [9].

Eighty pigs from a Piétrain x (Duroc x Landrace) crossbred were selected: 20 entire males (EM), 20 surgically castrated males (CM), 20 vaccinated males (IM) and 20 females (FE). Vaccination (Improvac® Pfizer Animal Heath) was administered as two 2 mL doses (at 77±3 and 146±3 days of age). Pigs were slaughtered at approximately 174 days of age in controlled conditions at IRTA's experimental slaughter plant in Monells (Spain). Twenty four hours *post mortem* a piece of *longissimus thoracis* with subcutaneous fat was collected and frozen at -20ºC.

Twenty four hours before testing, test loins were thawed at 4ºC and cut into 1.5 cm-thick slices, with 3 mm of subcutaneous fat. Each slice was cut into 4 pieces 1.5 cm-thick, and with subcutaneous fat. Each piece was placed in an aluminium container, covered with aluminum foil and codified with a 3 digit code. A FAGOR Innovation Class A oven was pre-heated at 180ºC. Then the container was placed for 10 minutes in the oven and immediately served to consumers.

Two hundred and one consumers (18–77 years of age) were selected at random but trying to simulate the Spanish population distribution in terms of gender and age (Table 1). Twenty sessions of 10 consumers each (11 in one session) were carried out. In each session consumers evaluated 4 pieces of meat, one from each type of animal. Loins were served in a monadic way and the order of evaluation followed a design to avoid first sample and carry-over effect [10].

Consumers' evaluated odour and flavour acceptability of meat using a 9-point category scale without the intermediate level (like extremely, like very much, like moderately, like, dislike, dislike moderately, dislike very much, dislike extremely).

Furthermore, sensitivity of consumers to androstenone was evaluated. They smelt pure androstenone as previously described in [7] and chose the level of odour perceived, using the following scale: 0, 'I do not perceive any odours'; 1, extremely weak; 2, very weak; 3, weak; 4, strong; 5, very strong; 6, extremely strong. Consumers that scored 4 or more were considered sensitive. The others were considered as less sensitive and insensitive.

Differences between sensitivity to androstenone by gender and age were evaluated using Fisher's exact test. Consumers' responses to odour and flavour were evaluated using the MIXED procedure (SAS Institute Inc., Cary, NC, USA). Type of meat was included as a fixed effect, session as a blocking variable, and consumer as random effect. Consumers' responses were analyzed considering all consumers together, and grouped according to their sensitivity to androstenone. Significant differences among least squared means were determined using Tukey's test.

III. RESULTS AND DISCUSSION

Table 1 shows consumer characterisation according to their sensitivity to androstenone. Considering all the consumers globally, 45% were considered sensitive. This percentage is higher than those reported by [7] for German and Spanish consumers. According to other works [7][11], this percentage is significantly (P=0.016) higher in women than in men. Androstenone sensitivity was not influenced significantly by consumers' age. [8] found a significant effect of age, but in the above mentioned study consumers were divided into 3 groups, in accordance with their sensitivity.

Least squared means of odour and flavour scores given by all the consumers globally and grouped by sensitivity are presented in Table 2. Considering all the consumers combined, odour and flavour scores were significantly lower for EM than CM, IM and FE. Similar results were found by [12] with Japanese and Filipino consumers. When only sensitive consumers were considered, similar results were found although mean scores were somewhat higher for CM, IM and FE and lower for EM. Less sensitive-insensitive presented a tendency to have lower scores for EM meat, however, there were no significant differences in odour and flavour scores between different types of meat. Therefore consumers' sensitivity to androstenone affects pork acceptability, which is in accordance with [7]. In the cited paper, all consumers as a pool found no difference between meat samples with different androstenone levels, however, when only sensitive consumers were considered, significant differences were found. Nonetheless, the proportion of consumers classified as highly sensitive was 31% *vs*. 45% in the present study. This increment in the percentage of sensitive consumers could be responsible of the differences, indicating the importance of considering that characteristic when boar taint is evaluated.

IV. CONCLUSION

In summary, meat from IM is accepted by consumers at the same level of meat from FE and CM and is more acceptable than meat from EM. However, if only less sensitive-insensitive consumers were considered no significant differences between any type of meat could be found.

REFERENCES

[1] Frederiksen, B., Font i Furnols, M., Lundström, K., Migdal, W., Prunier, A., Tuyttens, F.A. & Bonneau, M. (2009). Practice on castration of piglets in Europe. Animal (in press).

[2] EFSA (2004). Welfare aspects of the castration of piglets. Scientific Report of the Scientific Panel for Animal Health and Welfare on a request from the Commission related to welfare aspects of the castration of piglets. *European Food Safety Authority AHAW/04-087*. URL: http://www.efsa.eu.int/science/ahaw_opinions/512_it.html

[3] Thun, R., Gajewski, Z. & Janett (2006). Castration in male pigs: techniques and animal welfare issues. *Journal of Physiology and Pharmacology, 57*(Suppl 8), 189-94.

[4] Jaros, P., Bürgi, E., Stärk, K.D.C., Claus, R., Hennessy, D. & Thun, R. (2005). Effect of active immunization against GnRH on androstenone concentration, growth performance and carcass quality in intact male pigs. *Livestock Production Science, 92*(1), 31-38.

[5] Zamaratskaia, G., Andersson, H.K., Chen, G., Andersson, K., Madej, A., & Lundström, K. (2008). Effect of gonadotropin-releasing hormone vaccine (Improvac $^{(R)}$) on steroid hormones, boar taint and performance in entire male pigs. *Reproduction in Domestic Animals, 43*(3), 351-359.

[6] Matthews, K., Homer, D.B., Punter, P., Béague, M.P., Gispert, M., Kempster, A.J., Agerhem, H., Claudi-Magnussen, C., Fischer, K., Siret, F., Leask, H., Font i Furnols, M. & Bonneau, M. (2000). An international study on the importance of androstenone and skatole for boar taint: III. Consumer survey in seven European countries. *Meat Science, 54*, 271-283.

[7] Weiler, U., Font i Furnols, M., Fischer, K., Kemmer, H., Oliver, M. A., Gispert, M. A., Dobrowolski, A. & Claus, R. (2000). Influence of differences in sensitivity of Spanish and German consumers to perceive androstenone on the acceptance of boar meat differing in skatole and androstenone concentrations. *Meat Science, 54*, 297-304.

[8] Font i Furnols, M., Gispert, M., Diestre, A., & Oliver, M.A. (2003). Acceptability of boar meat by consumers depending on their age, gender, culinary habits, sensitivity and appreciation of androstenone smell. *Meat Science , 64*, 433-440.

[9] Font i Furnols, M., Gispert, M., Guerrero, L., Velarde, A., Tibau, J., Soler, J., Hortós, M., García-Regueiro, J.A., Pérez, J., Suárez, P., & Oliver, M.A. (2008). Consumers' sensory acceptability of pork from immunocastrated male pigs. *Meat Science, 80,* 1013-1018.

[10] MacFie H.J., Bratchell, N., Greenhoff, K. & Vallis, L.V. (1989). Designs to balance the effect of order of presentation and first-order carry-over effects in hall tests. *Journal of Sensory Studies, 4*, 129-148.

[11] Gilbert, A. N., Wysocki, C.J. The smell survey. Results. *National Geographics*, 1987, 172, 514-525.

[12] Hennessy, D. (2006). Global control of boar taint. Part 4. Immunological castration in action. *Pig Progress, 22*(6), 2-4.

Table 1: Classification of consumers in accordance with their sensitivity to androstenone, gender and age

	General (n)	Sensitive (%)	Less sensitive-insensitive (%)
Gender (P=0.016)			
Men	104	36.5	63.5
Women	97	53.6	46.4
Age (P=0.177)			
18-25 years	34	38.2	61.8
26-40 years	66	36.4	63.6
41-60 years	66	51.5	48.5
61-77 years	35	54.3	45.7
Total (n)	201	90	111
Total (%)	100.0	44.8	55.2

Table 2: Least squared means and standard error (SE) of consumers' assessment of the odour and flavour of meat depending on type of animal considering all the consumers in total and separated in accordance to their sensitivity to androstenone[+].

	N	CM	IM	EM	FE	SE
Total						
Odour	200	6.2[a]	6.2[a]	5.4[b]	6.2[a]	0.11
Taste	199	6.4[a]	6.4[a]	5.7[b]	6.2[a]	0.10
Sensitive						
Odour	90	6.5[a]	6.4[a]	5.2[b]	6.5[a]	0.17
Taste	90	6.5[a]	6.4[a]	5.4[b]	6.3[a]	0.16
Insensitive or less sensitive						
Odour	110	6.1	6.3	5.7	6.3	0.16
Taste	109	6.4	6.4	6	6.1	0.14

N: Number of consumers

[+] Different letters within consumer group indicated significant differences ($P<0.05$)