

Survey on the acceptance of the vaccination against boar taint

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SUMMARY

In Switzerland, surgical castration of piglets without anaesthesia has been banned since January 1, 2010 due to welfare concerns. Castration has been practised in pig meat production as it guards against 'boar taint' – whereby an off odour is released when heating fat or meat from some entire male pigs. The main compounds involved in boar taint are androstenone, skatole and indole. As a vaccine against boar taint is now available, and field experience shows that its use is practical and effective, this may provide an acceptable solution. However, such practice must be acceptable to consumers regarding welfare and safety concerns. In addition, the procedure must guarantee good meat quality. The aim of the present study was to evaluate the acceptance of meat produced with or without vaccination against boar taint (immunocastration) via sensory evaluation of the meat and personal views regarding the use of such a procedure by consumers, who had been informed on the subject. It comprised a sensory evaluation comparing meat from immunocastrated and conventionally produced pigs (surgically castrated male pigs) as well as a survey to examine the attitude to different methods of boar taint control among consumers. Meat derived from immunocastrated pigs and castrates did not show any differences with respect to the sensory grading of appearance, tenderness, taste and juiciness ($P>0.05$). Twenty-two percent of the interviewees indicated no prior knowledge of the problem of boar taint. Sixty-eight percent agreed on immunocastration being an acceptable alternative whilst 15% rejected this method. Respondents who judged immunocastration as comprehensible (they were of the opinion that they understood the procedure and the basics behind it) were more favourable of it compared to interviewees who considered it as sophisticated and unclear. The results of the survey showed that immunocastration can reach good acceptance among consumers within this region, and acceptance of this

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method of boar taint control may be increased by providing consumers clear information on the practice.

Keywords: boar taint, castration, immunocastration, survey, consumer attitudes

INTRODUCTION

In many countries, male pigs are castrated at an early age in order to prevent the development of boar taint, which is a perceived off-flavour in meat from intact males. The unpleasant odour of boar taint is associated with the adipose tissue of the pig and, more precisely, with the non-saponifiable fraction of the fat (Craig et al., 1962). More than one compound is responsible for boar taint; the key compounds are androstenone, skatole and indole (Babol and Squires, 1995). Sensitivity within consumers to the taint can be variable (Bonneau et al., 2000, Lunde et al., 2010). Surgical castration by the farmer without the use of anaesthesia is still the predominant practice in most places, but this practice is now questioned in an increasing number of countries due to animal welfare concerns (EFSA, 2004; Prunier et al., 2006). In Switzerland, castration without anaesthesia has been banned since January 1, 2010. Norway is now working with local anaesthesia during castration and the Netherlands have implemented castration under CO₂-narcoses. In Europe, a project providing information on pig castration for supporting EU policy has been conducted (PIGCAS, 2010). Throughout Europe different projects looking at animal performance, carcass composition and quality have been conducted to test and implement fattening of boars with or without the use of the vaccine Improvac (Pfizer Inc.). In Switzerland Improvac has been registered since January 1, 2007 and is available to be used as an alternative to traditional castration methods. Published data has already proven the effectiveness of the vaccine to control boar taint (Jaros et al. 2005; Pauly et al., 2009; Zeng et al. 2002). Compared to barrows, pigs vaccinated against boar taint maintain male anabolic potential for a longer period in the production phase (Metz and Claus, 2003), which has high practical relevance in terms of pig performance. In several studies comparing barrows, immunocastrates and entire male pigs, it was found that immunocastrates had higher average daily gain and better feed conversion ratio (FCR) than barrows (Dunshea et al., 2001; Turkstra et al., 2002). This improved performance is accompanied by improvements in carcass composition. Pauly et al., (2009) determined significant improvements in lean meat percentage in immunocastrated animals compared to castrates. Working with a trained panel, Pauly et al. (2010) reported no difference in meat odour, flavour or tenderness between castrates and immunocastrates; however, the meat from castrates scored significantly higher on juiciness.

To successfully introduce immunocastration in Switzerland on a large scale, more detailed information is needed regarding consumer acceptance. Initial Swiss consumer surveys showed that castration under anaesthesia exhibited the highest acceptance as an alternative to the current practices used in castration (Huber-Eicher, 2008). The practice of rearing entire males had a low acceptance, whereas the attitude of the respondents towards immunocastration was not negative. In a second study the interviewees were either undetermined or rejected all methods (Huber-Eicher and Spring, 2008). However, the term 'immunocastration' was not perceived as negative. 10.8% of the interviewees wrongly associated it with the negatively identified term 'hormones'. This lack of approval found in Switzerland contrasts with results of a Swedish study, which reported that Swedish consumers place a higher value on pork from immunocastrated pigs than on pork from surgical castrated pigs (Langerkvist et al., 2006).

Based on a series of preliminary interviews we hypothesised that for an effective introduction of immunocastration into the Swiss market, the consumer needs to be well-informed on this topic. The aim of the present study was to test (i) the sensory evaluation of meat derived from immunocastrated compared to surgically castrated pigs by consumers and (ii) the acceptance of immunocastration as an alternative method by consumers that had been informed about the method and its advantages and disadvantages.

MATERIAL AND METHODS

The study was conducted in the city of Langenthal (Switzerland), a small city selected for its favourable demographic distribution, as it represents a general proportion of the Swiss-German population based on income, age and consumer behaviour (Federal Office of Statistics, 2007a,b). All panellists were 18 years or older and were randomly selected. Sensitivity towards boar taint compounds was not tested. A total of 173 people took part in the sensory evaluation and consumer preference interview. The study was conducted in two parts, firstly comprising a sensory evaluation, followed up by a survey of attitudes to surgical castration and immunocastration.

Meat samples and analyses

The meat samples were obtained from 10 castrates and 10 immunocastrates each pig being a standard Swiss F1 cross breed (Large white (maternal line) x Swiss Landrace X Large white (paternal line)). The immunocastrates were vaccinated at approximately 25 kg body weight and 4 weeks before slaughter with Improvac (Pfizer Inc.). The vaccination was

conducted according to the recommendation by the manufacturer. The animals received a commercial diet that met standard nutrient recommendations (ALP, 2005) and were slaughtered in a commercial abattoir, by CO₂ stunning. Androstenone and skatole were analyzed as described by Pauly et al., (2008). Loin steaks measuring 14 mm thickness were cut and stored at -20°C.

Sensory evaluation

Before the test, the meat samples were defrosted at 4°C over 48 hours. The meat temperature was brought to room temperature before cooking. Samples were grilled directly before consumption. The samples were grilled on a hot plate (approx 200°C for 280 seconds (110 sec, turned, 140 sec, turned, 30 sec) without the addition of any flavouring agents. Both samples were presented simultaneously on one plate. The contacted persons were provided two pieces of meat for sensory analysis: one from an animal vaccinated with Improvac and one from a conventionally produced pig (surgically castrated male pigs i.e. castrate), respectively. The interviewees completed a questionnaire, indicating their perceived sensory analysis of the two samples. Each sample was evaluated regarding appearance, tenderness, taste and juiciness on a scale from 1 to 7 (dislike, like). In addition, they were asked for the preference for one of the pieces (prefer A, prefer B, no difference).

Consumer survey

Each person was briefed on general information on the actual situation of piglet castration and on possible alternatives (basic information on castration under anaesthesia) as well as detailed information on vaccination against boar taint (immunocastration) by means of posters and explanations by trained persons (Table 1). The interviewees completed a second questionnaire indicating their opinion on the different castration methods. The questionnaire addressed the following four subjects on a scale from 1 to 5.

1. Existing knowledge regarding castration of piglets prior to survey (1 = no knowledge to 5 = comprehensive knowledge)
2. Evaluation of immunocastration based on key words: natural, animal friendly, safe, comprehensible (1 = unnatural to 5 = natural, ...) and comparison to castration based on animal welfare, meat quality, and safety.
3. Acceptance of immunocastration (1= rejection to 5 = acceptance)
4. Choice of preferred method of castration (immunocastration versus castration under anaesthesia)

Statistical analyses

Carcass weight and lean meat percentage were analyzed by students T-test. Androstenone and skatole concentrations were analyzed with the non-parametric Friedman test. The sensory data were analyzed with repeat measure ANOVA (NCSS) with the individual pig serving as the experimental unit ($P < 0.05$).

Consumer attitude toward the procedure was analyzed by Chi-square-goodness-of-fit test comparing score 1 and 2 to 4 and 5 (Lowry, 2007).

Table 1 Overview of information on immunocastration given to the interviewees

Mode of action of vaccine:
➤ The animal will be vaccinated with a protein similar to messenger substances of the body.
➤ After the second injection, the animal produces temporarily a lot of antibodies, which neutralize a messenger.
➤ The antibodies interrupted the control of the testis and reduce its function temporarily.
Application:
➤ Every animal is vaccinated once as piglet and once as adult.
➤ The second vaccination is applied approximately 5 weeks before slaughter.
Vaccine:
➤ The vaccine is an inactive protein.
➤ The vaccine induces an immune response, but has itself no physiological activity.
➤ The antibodies remain in the meat; however, they are destroyed during cooking and digestion as are other meat proteins.

RESULTS

Eighty-eight percent of the respondents provided personal information. Over half of the interviewees (55%) were less than 50 years old (national average: 57%). When the profiles of the respondents were analyzed, gender (58% men) was found to be significantly different from the demographic composition of the Swiss population (49% men) ($\chi^2 = 4.765$, $df = 1$, $p < 0.05$). Education level of the respondents (70% with apprenticeship or higher education, 38% with high school / college degree) did not differ from the average of the Swiss population ($P > 0.05$) (Federal Office of Statistics, 2007a,b).

Carcass analyses

The average carcass weight was 85.3 ± 2.4 kg for castrates and 84.3 ± 2.7 kg for immunocastrates ($P > 0.05$). The average lean meat percentage was 55.5 ± 1.65 % for castrates and 56.7 ± 1.12 % for immunocastrates ($P < 0.10$).

Androstenone and skatole were low in all samples (measured in adipose tissue): androstenone ≤ 0.2 and $0.2 \mu\text{g/g}$ ($P > 0.05$) and skatole 0.03 and $0.04 \mu\text{g/g}$ ($P > 0.05$) for castrates and immunocastrates, respectively.

Sensory evaluation

Sensory meat quality is influenced by a series of complex factors. Beside flavour and odour, tenderness and juiciness are considered important attributes (Wood et al., 1999). The perceived quality of meat derived from immunocastrated and conventionally produced pigs did not reveal any differences with respect to appearance, tenderness, taste and juiciness on a scale from 1 (dislike) to 7 (like) (Table 2). The question on the preferred piece resulted in equal approval of immunocastration and surgical castration under anaesthesia (42%) with 16% of people panellists detecting no difference.

Table 2 Consumer scores for appearance, tenderness, taste and juiciness of meat from castrates and immunocastrates (1= dislike to 7 = like; n=166)

Parameter	Castrates	Immunocastrates	SE	P
Appearance	5.14	5.18	0.11	0.72
Tenderness	4.79	4.89	0.11	0.79
Taste	4.78	4.75	0.12	0.53
Juiciness	5.19	5.17	0.10	0.37

Attitude to castration method

Regarding prior knowledge, only 22% of the interviewees had not been aware of this issue. The frequency of men who stated that they were familiar with pig castration was higher than the percentage of women ($\text{chiq} = 4.042$, $\text{df} = 1$, $p = <0.05$).

The evaluation based on key words (scale from 1-5) showed that immunocastration was positively judged regarding animal welfare (4.05 ± 1.05), however, people raised some concerns regarding the procedure being natural (2.29 ± 1.20). When comparing the procedure to castration under anaesthesia, immunocastration tended to rate higher ($P < 0.10$) on animal welfare. The score for the safety of the procedure was numerically lower ($P < 0.15$) (Figure 1).

A total of 68% of the respondents accepted fully (17%) or partially (51%) vaccination as a feasible alternative whereas 15% of them rejected it (10% partial refusal, 5% complete refusal). People younger than 50 were more likely to agree significantly with the procedure than people over 50 years of age ($\text{chiq} = 6.092$, $\text{df} = 1$, $p = <0.05$). Respondents who judged immunocastration as comprehensible (they were of the opinion that they understood the procedure and the basics behind it) were more favourable of it compared to interviewees who considered it as sophisticated and unclear (Table 3). This difference was statistically significant ($\text{chiq.} = 7.97$, $\text{df} = 1$, $p = <0.05$).

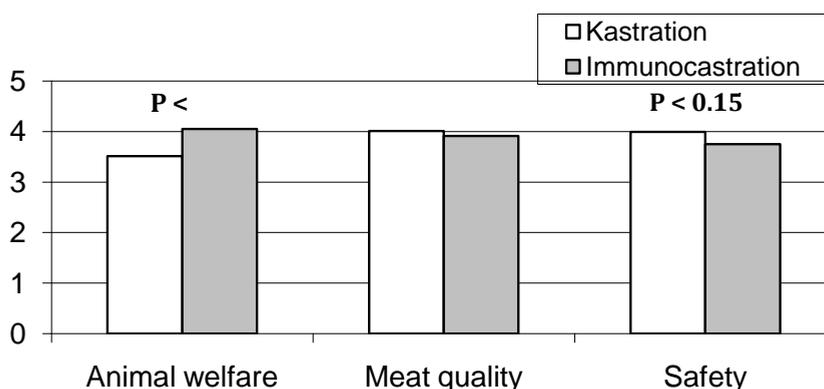


Figure 1 Scores for castration under anaesthesia and immunocastration regarding animal welfare, meat quality and safety (scale from 1-5).

When comparing the different alternatives, immunocastration was chosen as the preferred method by 56% over castration under anaesthesia (25%) ($\chi^2 = 19.06$, $df = 1$, $p = <0.05$).

Table 3 Effect of the level and depth of understanding the procedure of immunocastration on its acceptance

	Acceptance	Partial acceptance	Equal	Partial refusal	Refusal	Total
Immunocastration is unclear	5	14	15	8	5	47
	40%*		32%	28%		100%
Immunocastration is comprehensible	21	64	12	5	3	105
	81%*		11%	8%		100%

* $\chi^2 = 7.97$, $df = 1$, $p = <0.05$

DISCUSSION

Immunocastration against boar taint can offer a suitable alternative; however, both meat quality from immunocastrated pigs and the procedure as such have to be accepted by the consumer. Two methods are conceivable to assess boar taint: the measurement of androstenone, skatole and indole by chemical analysis or a sensory survey. Consumer surveys showed the incidence of boar taint in carcasses from entire males to be variable, ranging from 10 to 75% according to different studies (EFSA, 2004). Taking into account that androstenone, skatole and further compounds contribute to boar taint and considering the large differences in consumer sensitivity to these compounds

(country, sex, anosmia) (Bonneau *et al.*, 2000, Lunde *et al.*, 2010), any alternative method should be tested to suite a specific market. The findings from the present test suggest sensory scores for meat from immunocastrated animals to be comparable to castrates. This is in general agreement with data published by Pauly *et al.* (2010), who reported no difference in meat odour and flavour or tenderness between castrates and immunocastrates. In contrast to the present test, Pauly *et al.* (2010) worked with a trained panel, which was selected based on their ability to detect and judge boar taint. In their study, the meat from castrates scored significantly higher on juiciness. As outlined by DeVol *et al.* (1988) and Fortin *et al.* (2005), the conflicting results for juiciness may be caused by differences in the intramuscular fat percentage or could also be attributed to the fact, that a trained panel is able to detect smaller differences. Intramuscular fat percentage was not measured in the present samples. In agreement with the present study Font i Furnols *et al.* (2008) also determined equal preference for pork from barrows and immunocastrates by a consumer panel. As consumer panels do contain a certain percentage of people being anosmic to androstenone, they can be less stringent than expert panels. However, overall the findings of the present survey demonstrated that boar taint can be controlled efficiently enough by immunocastration to maintain the sensory quality of the meat similar to conventional castrates. The immunocastrates in the present study were produced at small scale with special attention given to assure proper vaccination procedure. The consistent vaccination and/or the detection of unvaccinated animals at the slaughter line could remain a challenge if the procedure is applied at large scale.

When examining the attitudes of the respondents to castration methods, the fact that 78% of respondents overall had heard of this topic reflected the high profile of the issue before and during the time of the study. A follow up survey on the same topic, which was conducted with 500 people, revealed a lower profile of the issue (Spring *et al.*, 2011). It is possible that the results were influenced by a particular high degree of publicity regarding castration methods at the time of the present survey.

The hypothesis that the method would be accepted by well informed consumers was confirmed in the present study, in which the majority (68%) of the interviewees accepted immunocastration as a possible solution. The survey showed for immunocastration a tendency towards a higher score regarding animal welfare. This could be a key factor influencing the attitude of the consumers towards meat production procedures. The National Swiss Animal Protection Group (STS, 2008) has stated that it prefers immunocastration over any surgical procedure regarding castration. This might have influenced public opinion. It was interesting to note that immunocastration received an overall higher acceptance among younger people, which could be due to more

conservative attitudes of older people towards new technologies. Novoselov (2007) also reported a more positive attitude of younger people and people with higher education towards the use of genetic modification in pork production. Overall acceptance was higher among interviewees who considered immunocastration as comprehensible, meaning they were of the opinion that they understood the procedure and the basics behind it. This indicated that information and education is important when introducing new methods of meat production into the market place. Immunocastration was chosen as the preferred method by 56% over castration under anaesthesia. This is in agreement with Lagerkvist *et al.* (2006) who reported that consumers place a higher value on pork from immunocastrated pigs than on pork from surgically castrated pigs. However, the present comparison of methods has to be interpreted carefully as the results suggest that acceptance for a new production method can be increased by more availability of information. The present study focussed on immunocastration and so the information given to the respondents was more detailed and targeted for this procedure compared to castration under anaesthesia. In order to achieve a complete comparison, the information needs to be balanced among available castration procedures. It should also be pointed out that 15% of the interviewees rejected (10% partial refusal, 5% complete refusal) immunocastration as an alternative method, which could negatively affect the market should the procedure be introduced at a larger scale.

Based on the present study it can be concluded that i) meat from immunocastrates can achieve similar sensory grading as meat from castrates, ii) consumer acceptance for immunocastration against boar taint can be reached in the Swiss market. However, it is necessary to inform the consumer, in a transparent and comprehensive manner, about the advantages and disadvantages of any new method.

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