



ALCASDE – Final report

Study on the improved methods for animal-friendly production, in particular on alternatives to the castration of pigs and on alternatives to the dehorning of cattle

9th December 2009

SANCO/2008/D5/018

Project coordinator: Dr. M.A. Oliver (IRTA)

FINAL REPORT OF THE CONTRACT SIGNED WITH:

INSTITUTION: Directorate General for Health and Consumers,
Animal Health and Welfare Directorate (SANCO)

TITLE: Study on the improved methods for animal-friendly
production, in particular on alternatives to the
castration of pigs and on alternatives to the dehorning
of cattle.

CONTRACT CODE

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ORGANIC CODE

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REPORT RELATED TO THE CONTRACT

TITLE: Study on the improved methods for animal-friendly production, in particular on alternatives to the castration of pigs and on alternatives to the dehorning of cattle

Participants

**Directorate General for Health and Consumers, Animal Health and Welfare Directorate
(SANCO)**

and

**INSTITUT DE RECERCA I TECNOLOGIA AGROALIMENTARIES
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PUBLISHABLE EXECUTIVE SUMMARY

Study of the improved methods for animal friendly production, in particular on alternatives to pig castration.

M. A. Oliver, C. Thomas, M. Bonneau, O. Doran, G. Tacke, G. Backus.

The overall objective of the project was to provide recommendations based on research results on alternatives to the surgical castration of pigs to support EU policy. The specific objectives of project were: to develop and promote alternatives to the surgical castration of pigs, specially the production of boars; to develop methods for boar taint detection on the slaughter line; to develop objective measurement for the meat quality and to carry out a survey on the demand and acceptance of consumers of meat from boars.

A module was designed aiming at ensuring the dissemination of knowledge generated by the project through stakeholder involvement, e-learning techniques, website and specific workshops. A website (www.alcasde.eu) was set up to describe project objectives and actions and also to allow exchange between partners. An e-learning (web based interactive) course on Alternatives to Pig Castration was developed and is available through the project website. To allow a wider stakeholder comment on project outputs, an International Symposium on Pig Castration was organized in Bologna in October 2009. Alternatives to castration and markets for meat from entire males were discussed. It was attended by 78 delegates, representative of stakeholders, scientific community and society of Europe (15 countries and 50 institutions). The main conclusion of the Symposium was that the production of entire males is a feasible option in some markets, but there is a risk that such meat might not be accepted by consumers because boar taint-free meat cannot be guaranteed. Also the scale of production might exceed market demand for boars. As a general outcome of the Symposium, promotion of meetings between stakeholders, representatives of the society and scientists to discuss together issues of common interest in a European context is highly recommended. Further development of e-learning materials and translation to other languages is also recommended.

Alternatives to surgical castration through management were studied and the main results obtained were: Farmers did not perceive having more problems than usually met with castrated males. Androstenone and skatole levels were determined in a limited number of farms; the incidence of boar tainted carcasses could not be determined due to the absence of clear threshold acceptability levels. Housing conditions and enrichment of the environment can improve the welfare in both males and castrates by reducing aggressiveness and probably also the level of chronic stress, although further studies are needed to confirm this. The project also investigated a possibility of the development of breed-specific genetic tests for boar taint which could be used for selective breeding. Breed-specific mechanisms controlling skatole and androstenone accumulation were studied and a number of candidate genes have been identified.

Three different approaches for the development of skatole and androstenone on-line sensors were investigated and (i) description of a novel rapid method for analysis of skatole and androstenone in solid phase (fat) was provided; (ii) optimized conditions and sampling strategies for FTIR-Photo Acoustic Spectroscopy for skatole and androstenone analyses in gas-phase and solid-phase were determined and (iii) description of the ‘trained insects’ approach for

the boar taint compounds detection was provided. A programme for future research and commercialisation of on-line skatole and androstenone detection methods was developed. In addition an inter-laboratory comparison of skatole analyses by four traditional techniques was conducted. On the basis of the outcomes obtained, recommendations and a programme for research on harmonisation of boar taint detection methodology were given. An industry-orientated workshop was organised in order to stimulate dialog between researchers and industry; to give overview of the existing and developing technologies; and to obtain industry view and specifications for boar taint detection technology.

The evaluation of the demand and acceptance of consumers was another main objective of study. A European consumer study was conducted in six countries, France (FR), Germany (DE), Italy (IT), The Netherlands (NL), Spain (ES) and United Kingdom (UK), to provide scientific results on attitudes and acceptability. Consumer preferences towards pig castration and boar taint were heterogeneous across countries. The analytical hierarchy process showed that, in general, the aggregated weight of the attribute 'gender of the animal' on buying decision goes from 5.90% to 10.42%, while 'expected price' and 'expected taste' were the more important attributes, going from 18 to 33% and to 40 to 57%, respectively. In the acceptability test, loin meat from females, from entire males with boar taint and from entire males without boar taint, was blindly tested. The tested samples had different androstenone levels among countries: In DE, NL, FR and IT levels were around 2 µg/g while in ES and UK they were around 1 µg/g. Differences on acceptability (How delicious, abnormal odour, taste...) among consumer from the different countries were found. In FR, IT and NL significant differences were found between the consumer perception of tainted boar meat and gilt meat; tainted boar meat was considered less acceptable. However in ES, UK and DE these differences were not significant. In conclusion tainted meat would not be accepted by a certain percentage of consumers (10 to 48% depending on the country and the androstenone level of the meat). From the people that perceived abnormalities, 28 to 74% would not serve the meat to their family, 40 to 56% would not buy pig meat again for a while and 22 to 61% would not revisit the shop. The present study provides a basis to confirm that Northern-Western countries are more aware to animal welfare while in the Southern countries there is more attention to expected taste.

Finally, an economic assessment of pig meat chains without surgical castration was performed. A pilot model was applied for NL, FR ('genetic selection, altering management strategies and slaughter at a lower weight' scenario) and IT ('immunocastration' scenario). The cost-effectiveness of measures to reduce levels of androstenone, skatole and indole varied greatly. For NL and FR, combined selection on boar taint and on economics traits was much more cost-effective than selection pressure on boar taint only, and also much more cost-effective than slaughtering at a lower weight. Split-sex group rearing was very cost-effective. Assuming market acceptance for non boar tainted meat and limited market acceptance for boar tainted meat, the results indicate that raising boars may be beneficial mainly due to a better feed conversion ratio. The costs and benefits of raising boars were not equally distributed across the various segments of the pork chain. Pig farmers would benefited from a better feed conversion ratio, and slaughter plants were confronted with a discount for boar tainted meat. The calculated discount for boar tainted meat was low compared to the feed cost reduction, although further studies are needed to confirm this. These costs may, however, increase when large numbers of European pork producers convert to raising boars. The immunocastration scenario for IT resulted in a better economic farm performance.

As a general conclusion of the project, it cannot be recommended to ban pig castration in a short-time period, mainly because the meat from boars cannot be guaranteed to be free of boar taint. Due to the potential risks that it would entail (i.e. economic, welfare, meat quality) a combination of different strategies rather than a single solution is envisaged.

The following points summarize the need for short-term research:

- 1-Comprehensive large-scale international research on harmonisation of boar taint detection technologies, and completion of the development and validation of novel rapid on-line skatole and androstenone detection methods in close collaboration (and following specifications) with the end-users.
- 2-An European survey to determine the incidence of various androstenone and skatole levels at breeding stage and at the production level. Further studies are also needed to improve pig welfare in relation to the different alternatives to castration.
- 3- Large scale study to go in depth into preferences and behaviour of European consumers in relation to fresh pig meat products, and cured or smoked products from entire males and females. This study should be performed in collaboration with end-users such as Consumer Associations and retailers within different Eastern, Southern, Western and Northern countries and would provide information on the niche markets from meat from entire males.

Study of the improved methods for animal friendly production, in particular on alternatives to cattle dehorning.

L. Mirabito, I. Vessier, G. Cozzi, U. Knierim, O.N. Pentelescu.

The overall objective of the project was to provide recommendations based on research results on alternatives to the dehorning of cattle to support EU policy. The specific objectives of the project were: to perform a survey of today's situation regarding dehorning in the EU Member States and assessing the existing alternatives; to gather and summarize information on the possible effects of dehorning on the development of the animals and to develop further alternatives to the dehorning together with strategies to promote them.

A module was designed with the aim of ensuring the dissemination of knowledge generated by the project through stakeholder involvement, e-learning techniques, website and specific workshops. A website (www.alcasde.eu) was set up to describe project aims and actions and also to allow exchange between partners. An e-learning (web based interactive) course on Cattle Dehorning was developed and is available through the project website.

To describe the cattle dehorning situation in Europe a large scale survey was carried out. Recorded data were processed for each member state as well as at the European and at macro-regional levels (North, Centre, East and South of Europe). Results indicate that in Europe dehorning is a widespread practice, involving about 82% of dairy, 63% of suckler and 39% of beef cattle. The percentage of dehorned animals is the highest in the North macro-region, although significant national and local differences have been noticed. Dehorning is performed primarily in cattle housed in free-stall systems by disbudding young calves. This practice is mainly carried out by the stockman by cauterisation with a hot iron. The use of sedation, anaesthesia and analgesia is inconsistent. The overall prevalence of polled cattle is very low, particularly in the dairy cattle population (<1%). Focus groups were organised in France, Germany and Italy to get a better understanding why farmers dehorn (or not) their cattle. Work safety reasons and reduced risk of injuries among pen-mates were most frequently mentioned as reasons for dehorning or keeping polled animals, especially in loose housing. In favour of keeping horns, different motivations such as ethic reasons (cattle integrity, avoidance of pain and stress), a good farmer-animal relationship, and a presumed better cattle health and product quality were mentioned. Disbudding is considered by the majority to be easier for the farmer and less painful for the calves than the dehorning of adults.

Two reviews of scientific and technical publications were carried out on benefits and drawbacks of cattle dehorning/disbudding and their alternatives: keeping fully horned cattle or introducing polled animals. The subproject partners and EAAP Cattle Working Group members were given opportunity to contribute. Arguments for and against dehorning disbudding were related to human safety, animal welfare, ethics, economics, cultural aspects and product quality. While dehorning has stronger negative welfare effects than disbudding, any method of disbudding/dehorning causes distress and pain, which should be alleviated as far as possible, preferably by a combination of sedation (in animals not used to handling), local anaesthesia and anti-inflammatory treatment. For keeping fully horned cattle specific housing and management recommendations are available that include a higher number of minimum recommendations than those for hornless cows. However, the identified risk areas are similarly relevant for horned and hornless cattle. There is a lack of scientific studies into the relevance of horns for cattle.

The natural absence of horns is determined by a single gene, with polled (= hornless) being dominant over horned. The frequency of polled varies between breeds from 0 to 100 %. In Holstein, polled animals have a low genetic merit. Classic breeding programs to increase the frequency and genetic merit of polled animals take long. Computer simulations showed that with genomic selection high genetic merit polled bulls can be bred within 10 years. Consultations showed that farmers are only interested in using polled bulls if they have a high genetic merit, and breeding companies are starting to develop breeding programs in Holstein. In Fleckvieh, breeding programs are well under way.

Finally, a third work package was designed to develop short and long term strategies with regard to cattle dehorning. The first subtask dealt with two approaches to alternatives to dehorning: keeping horned cattle and breeding for polledness. For both approaches benefits and drawbacks as well as solutions to overcome barriers were discussed. The main action points with regard to the keeping of horned cattle lie in the promotion of adequate housing conditions, information and advice for farmers and compensation for possible economic losses. Main emphasis with regard to breeding for polledness should be on the naturalness of polled cattle and their behaviour and on the ethical implications of different breeding strategies. The second report based on the outputs of an International Conference organized in Bologna in October 2009, brought together researchers and stakeholders to discuss and to find viable solutions to overcome barriers. Participants expressed a need for improvement of disbudding procedures and agreed to limit dehorning to a minimum. Furthermore, breeding strategies for polledness and keeping of horned cattle were acknowledged. As a general outcome of the conference, promotion of meetings between stakeholders, representatives of the society and scientists to discuss together issues of common interest in a European context is highly recommend. Further development of e-learning materials that provide the opportunity to disseminate widely specific technical information is also recommended. Consideration needs to be given to translation of the course into Russian and East European languages to widen its impact.

The final recommendations on alternatives to dehorning refer in the short term to the improvement of disbudding practices including proper use of anaesthesia and analgesia and the restriction of dehorning to emergency cases. Long-term alternatives consist of the introduction of the polled gene in cattle and the keeping of horned cattle, always taking animal welfare as well as farmer and consumer concerns into account.

The following points summarize the need for future research:

- 1-Keeping polled cattle and keeping horned cattle are two alternatives to dehorning in the future and policy decisions have to take into account the need of a balance between these two options.
- 2-Assuming that high genetic polled bulls will be available in coming years, it is then advised to monitor the consequences, in particular in term of possible detrimental effect on the animals themselves and on the possibility for farmers to keep on rearing horned cattle.
- 3-As keeping horned adult cattle is rare, it is further suggested to support farmers who, by keeping horned cattle, can suffer economic losses due to higher costs and research on the housing and management of horned cattle.

WORKPACKAGE REPORTS

MODULE A: MANAGEMENT OF THE PROJECT

Main objectives

This module had the following objectives:

- A.1. To manage, coordinate and administrate the project during its lifetime.
- A.2. To link the project with the Directorate General for Health and Consumers, Animal Health and Welfare Directorate (SANCO).
- A.3. To plan and organize the meetings of Management Team and Technical Committees of Subproject 1 and Subproject 2.
- A.4. To provide recommendations on alternatives to castration and dehorning to SANCO to support EU policy.

Progress towards objectives

Four tasks were performed within Module A:

- Task A.1. Contractual and legal management of the project (IRTA).
- Task A.2. Administrative (EAAP and IRTA) and financial management (IRTA) of the project and the overseeing of science, ethical, society and gender issues (M.A. Oliver).
- Task A.3. Planning, organizing and reporting of meetings of Management Team with respect to general issues (M.A. Oliver).
- Task A.4. Elaboration of the final report, including recommendations to SANCO to support EU policy (M.A. Oliver and L.Mirabito).

Task A.1. Contractual and legal management (IRTA)

Objective: To manage, coordinate and administrate the project during its lifetime.

IRTA prepared the first draft of a Consortium Agreement (CA) to regulate the partnership between the different partners and to specify or supplement binding commitments among themselves in addition to the provisions of the Service Contract SANCO/D5/2008/SI2.517191. The final version included the suggestions received from the partners.

The CA was signed by all the participant organizations in order to ensure the achievement of the objectives planned in the ALCASDE project and to define the technical, administrative, financial and legal obligations of the partners and IRTA, as the coordinator. An Addendum of the C.A. with the partners' background to be protected was also prepared in the meanwhile.

This C.A. provided the details of the requirements for the payments and a template for the delivery to the Commission of the statement of travel expenses to the partners. The periods of the reports' delivery were fixed as well.

Also, the joint and validation of the travel expenses (reimbursable expenses) of all the partners was made by IRTA in order to make sure that the expenses were directly connected with execution of tasks before the delivery of them to the Commission. The payments to the partners were made according to the CA, as well.

Task A.2. Administrative (EAAP and IRTA) and financial management (IRTA) of the project and the overseeing of science, ethical, society and gender issues (M.A. Oliver).

Objective: To link the project with the Directorate General for Health and Consumers, Animal Health and Welfare Directorate.

The necessary actions for the request of the pre-financing, the payment of the interim report and the payment of the balance were carried out following the requirements of the Commission (delivery of the bank guarantee, technical reports, the respective invoices and the statement of reimbursable expenses).

During all the period there were e-mail and telephone contacts with SANCO to clarify specific matters related with the development of the project.

The interim report (D.A.1) was presented to SANCO by the coordinator and leader of Subproject 1, and the two co-leaders of Subproject 2 in Brussels, following the requirements of the 'Specifications attached to the invitation to tender' document. The minutes of the meeting with SANCO is presented in the Appendix 'Module A' and includes some remarks from the Commission in relation to the future development of the project (Appendix Module A).

Task A.3. Planning, organizing and reporting of meetings of Management Team with respect to general issues (M.A. Oliver).

Objective: To plan and organize the meetings of the Management Team and the Technical Committees of Subprojects 1 and 2.

KOM meeting

IRTA organized the kick-off meeting (KOM) at SANCO premises in Brussels, the 7th and 8th January 2009. The meeting was attended by the components of the Project Management Team. On the 8th January there was also a meeting with SANCO representatives (Ms. J. Krommer, Mr. J. Dragset and Ms.D. Tissot). The main points discussed and the future actions derived from the KOM are summarised in Annex I (Appendix Module A).

General meeting in Wageningen

The meeting in Wageningen (Netherlands) on the 14th and 15th May was organized by LEI and IRTA together with EAAP. The agenda included:

- 1) Welcome (C. Steegman, from the Dutch Ministry of Agriculture);
- 2) General issues;
- 3) First draft of the interim report;
- 4) Parallel meetings of the WPs: interim report and future actions;
- 5) Module B: developing plan; workshops and International Conference 28th – 29th October;
- 6) Speech of B. Urlings, director of QA at Vion;
- 7) Future plan for each WP;
- 8) Final comments on the interim report and
- 9) Scientific Committee meeting.

The objectives expected from the meeting were:

- 1) Final version of the interim report
- 2) Detailed working plan for each WP to reach its objectives until the end of the project
- 3) Agreement on the content and objectives of the workshops and the International Conference

The minutes of the Scientific Committee meeting constitute Annex II (Appendix Module A).

The final meeting of the Scientific Committee was held in Bologna on October 28th and the minutes are presented in Annex IV (Appendix Module A).

Task A.4. Elaboration of the final report, including recommendations to SANCO to support EU policy

Objective: To provide recommendations on alternatives to castration and dehorning to SANCO to support EU policy.

Alternatives to pig castration

From the results of this pilot study, it cannot be recommended to ban pig castration in a short-time period, mainly because the meat from boars cannot be guaranteed to be free of boar taint. For this reason, the development of an international boar taint detection and sorting method is considered of importance. Such method(s) should be rapid, cost-effective, reliable and easy to apply in the industrial setting. Further studies are also needed (i) to answer the question whether entire males have better animal welfare compared to castrates and (ii) to determine at international level the acceptance of meat from boars by consumers.

The following points summarize the need for future research:

- 1- An European survey to determine the incidence of various androstenone and skatole levels at breeding stage (sire and dam lines), and at the production level. The reason for this is that differences among farms and countries depending on breeds, management and final weight used can be expected.
- 2- Feeding and management strategies (including transportation and slaughter practices) should be further developed in the production of entire pigs to guarantee sound animal welfare and high quality of the meat.
- 3- Comprehensive large-scale international research on harmonization of boar taint detection technologies, and completion of the development and validation of novel rapid on-line skatole and androstenone detection methods in close collaboration (and following specifications) with the end-users.
- 4- Large scale study on preferences and behaviour of European consumers in relation to fresh pig meat products (in addition to the loin), and cured or smoked products from entire males and females. This study should be performed in collaboration with end-users such as Consumer Associations and retailers within different Eastern, Southern, Western and Northern countries.
- 5- Harmonization studies to determine boar taint threshold levels for different pork meat products by consumers in different countries (EU and possible markets- importing countries).
- 6- Research for specific consumer markets for pig meat from entire males within EU and in importing markets such as Asia.
- 7- To evaluate the cost-effectiveness of alternative control packages (breeding, farm management measures, and detection and sorting methods at the slaughter line) and to ultimately define the optimal set of the interventions/control measures along the meat production chain for given boar taint threshold level.

Alternatives to cattle dehorning

Based on the findings of the project, it was finally recommended to restrict dehorning to emergency cases and to take initiatives to improve disbudding practices especially by better training and enhanced possibilities for farmers to use pain releaser.

The following points summarize the need for future research:

- 1- Keeping polled cattle and keeping horned cattle are two alternatives to dehorning in the future and policy decisions have to take into account the need of a balance between these two options.
- 2- Assuming that high genetic polled bulls will be available in coming years, it is then advised to monitor the consequences, in particular in term of possible detrimental effect on the animals themselves and on the possibility for farmers to keep on rearing horned cattle.
- 3- As keeping horned adult cattle is rare, it is further suggested to support farmers who, by keeping horned cattle, can suffer economic losses due to higher costs and research on the housing and management of horned cattle.

As a general outcome of the project, promotion of meetings between stakeholders, representatives of the society and scientists to discuss together issues of common interest in an European context is highly recommend. Further development of e-learning materials that provide the opportunity to disseminate widely specific technical information is also recommended.

Deviations from the project programme and corrective actions taken

In order to optimize resources and to have more available information to discuss, it was agreed during the KOM in January 2009 that the workshops planned in Task 1.2.4 (international industry-oriented workshop on boar taint detection technologies) and Task 2.3.2. (stakeholder's conference on alternatives to dehorning) would be held together with the International Seminar (Task B.4) the last week of October 2009.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.A.1	Interim report to the Commission (SANCO), including interim report SP1 and interim report SP2.	Apr 09	Jun 09	IRTA
D.A.2	Final report to the EC, including SP1 and SP2 reports. Recommendations on alternatives to castration and dehorning to SANCO to support EU policy.	Nov 09	Nov 09	IRTA

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.A.1	Kick off meeting (Management Team and Technical Committees).	Jan 09	Jan 09	IRTA
M.A.2	Second meeting of the Management Team.	Apr 09	May 09	IRTA
M.A.3	Final meeting (Management Team and Technical Committees) (SP1 and SP2).	Nov 09	Oct 09	IRTA

MODULE B: PROMOTION AND DISSEMINATION

Main objectives

This module had the following objectives:

- B.1. To create a participatory framework that will allow meaningful dialogue between the partners and the stakeholders to ensure that the project meets the needs of the end users
- B.2. To gain advice and feedback from the stakeholders to assist in the development of the research and dissemination process
- B.3. Using this framework to transfer the information from the project to the intended stakeholders / end users in an effective manner to ensure rapid take-up
- B.4. To establish contacts and facilitate the mutual knowledge between the scientific community and the stakeholders

Progress towards objectives

Two tasks were performed within module B:

Task B.1. To form a Stakeholder Platform to represent the end users of the information

Task B.2. To create a website to promote and disseminate the outputs from the project

Task B.1. To form a Stakeholder Platform to represent the end users of the information.

Extensive consultation took place between the workpackage leaders on appropriate members for the platform. A matrix of the 2 subprojects and stakeholder groups (e.g. farmer/ farmer organisations, abattoir/meat processor, retail/ consumer, veterinarians and health/welfare) was formed to ensure proper representation across the chain. The final list was agreed between WP leaders and invitations sent out. The final list of agreed participants is presented in Appendix 1 D.B.1. Members of the stakeholder panel were invited to a project planning meeting in Wageningen in May 2009 to consider the interim report. The minutes of this meeting are presented in the report for Module A (Appendix Module A, Annex II). In addition the platform was invited to the project Workshops/ Symposia in Bologna in October 2009. They made presentations of their views as stakeholders and also contributed to the discussion. Their contribution is reported under task B.4 and the reports of the workshop on Boar Taint and International Conference on Cattle Dehorning in SP1 and 2 (Appendix 4 DB4).

Task B.2. To create a website to promote and disseminate the outputs from the project.

A website has been created (www.alcasde.eu). Drafts were made and consultations were held with WP leaders before arriving at the final version. The site is split into a public area and a restricted site. The public area of the site contains a summary of the aims and tasks in the project and the partners involved. The restricted area is accessible only by password (Username = Project_Alcasde; Password = SANCO_2009). This area contains reports from various meetings and presentations made at the workshops/ symposia recently held in Bologna (October 2009). Finally the two e-learning courses on Pig Castration and Cattle Dehorning (Task B.3) are available on the restricted site. Details of the website structure are presented in Appendix 2 D.B.2. The site was continuously updated and EAAP is committed to continue support after the end of the project and to present material on the public site once released by SANCO.

Task B.3. To create e-learning materials for education and training.

Two interactive courses have been created on Pig Castration and Cattle Dehorning. The structure of these two courses is shown below in Tables B.1 and B.2. The courses can be accessed through the restricted site of the Alcasde website (www.alcasde.eu) using the username Project_Alcasde and password SANCO_2009.

Table B.1 Course on Pig Castration-Table of Contents

- A. What this is about, who it is by and who it is for?
 - 1. Orientation
 - 2. Aims and objectives
- B. Introductory Quiz
- C. Extent of pig production in the EU
- D. Pig Castration in the EU
 - 1. Extent of Pig Castration in the EU
 - 2. How the prevalence of castration varies in different EU countries
 - 3. Proportion of pigs castrated across the countries of the EU
- E. Consequences of raising entire male pigs
 - 1. What is boar taint and what causes it?
 - 2. Compounds related to boar taint
 - 3. Factors related to the presence of boar taint compounds.
 - 4. How boar taint compounds are perceived by consumers
 - 5. Anosmia
- F. Methods of Pig Castration
- G. Alternatives to Castration
 - 1. Production only of entire (uncastrated) males
 - 2. Production only of females / Spermatic selection
 - 3. Immunocastration
 - 4. Castration with anaesthesia and analgesia
 - 5. Summary of advantages and disadvantages of alternative methods
- H. Attitudes of producers and consumers towards pig production methods
 - 1. Attitudes of the producers
 - 2. Attitudes of consumers
- I. Summary and Post Tutorial Test
- J. For more information
 - 1. References

Table B.2 Cattle Dehorning - Table of Contents

- A. What this is about, who it is by and who it is for
 - 1. Orientation
 - 2. Aims and objectives
- B. Introductory Quiz
- C. Cattle Production in the European Union
- D. Cattle dehorning. What are we talking about?
- E. Cattle disbudding/dehorning. Current practices in Europe
 - 1. Reasons for Cattle Disbudding/Dehorning
- F. Methods of Disbudding and Dehorning
 - 1. Disbudding
 - 2. Methods of Dehorning
- G. Minimising the effects of dehorning upon cattle
 - 1. Methods of reducing pain during and after dehorning
 - 2. Alternatives to disbudding/dehorning
- H. Legislation
 - 1. Legislation in different countries
- I. Post-test
- J. Further information
 - 1. References

A fuller description of the site is given in Appendix 1 D.B.3.

Presentations of the two courses were made at the International Symposium on Pig Castration. Consideration needs to be given to translation of the courses into Russian and E. European languages to widen their impact.

Task B.4. *To create industry and public awareness through an International Stakeholder Seminar.*

An International Conference on Pig Castration was organised in Bologna on the 29th October 2007. Seventy-eight delegates participated in the International Symposium from 15 countries and 50 institutions from all over Europe, including scientists and stakeholders. A full report of the meeting is given in Appendix 1 D.B.4.

The main objective of the Symposium was to discuss the interim report including refinement of the policy options and involving key stakeholders in the chain and also those representing public opinion (e.g. Consumers, Welfare Organisations). To meet this aim, the Symposium was structured to:

- Outline the main interim results from the project
- Consider the views of key stakeholders
- Consider the situation with exporting (Denmark) and importing (C&E European States)
- Provide a Round Table discussion on alternatives to castration

Conclusions from the discussions of three main options presented at the Round Table were:

1. Production from entire males within five years

The production of entire males is a feasible option in some markets, but there is a risk that the production could exceed market demand for boars: Italy, Germany, Japan, Asia are importing countries or regions that nowadays do not accept meat from boars. For the Spanish market the production of entire male pigs is not a problem, but Spain is self-sufficient. English market accepts the pork from entire male pigs, but the consumption per capita is one lowest of the EU.

Future needs of research:

- To look for possible markets of entire males in EU and Asia,
- To look for specific markets within a country and identify new requirements for the industry,
- To study the preferences and behaviour of consumers towards the consumption of meat from entire males,
- To built an image of entire males: nutritional value and animal welfare,
- To perform an European harmonization of methods to detect boar taint,
- To develop new methods: rapid, easy and cheap.

2. Meat from boars without boar taint: Considering regional consumer markets in Europe differ considerably

In the EU there are markets that claim for high sensory traits, like the meat from females and barrows (more fat, better fat quality and better tenderness and juiciness), the production of Parma ham in Italy, or the production of Iberian and dry and cured products in Spain.

Future research needs:

- To look for alternatives to castrated animals for specific markets. Examples: Parma ham, Iberian products, High quality products in Spain.
- To study the utilization of alternatives to the castrated pigs aimed at these specific markets (depending on acceptance of the meat industries and consumers preferences)
 - o Females
 - o Immunocastrated

3. Gold Standard for boar taint should be based on consumer acceptance

It is difficult to define the 'Gold Standard' label based on the consumer acceptance because it may vary widely and change with the new generations. There is a need to find an easy way to control boar taint levels of carcasses.

Future research needs:

- To know consumers' level of sensitivity and thresholds of boar taint compounds,
- To study different meat products and identify industry's requirements for the raw meat dealing with boar taint.

Deviations from the project programme and corrective actions taken

There were no deviations from the project programme apart from a short delay to the appointment of the stakeholder group.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.B.1	Formation of a stakeholder group comprised of the representatives of the end users of project outputs to advice on application of methods.	Apr 09	Apr 09	EAAP
D.B.2	Project web-site set up.	Apr 09	Apr 09	EAAP
D.B.3	Interactive e-learning materials on website.	Nov 09	Nov 09	EAAP
D.B.4	International workshop Symposium organised.	Oct 09	Nov 09	EAAP

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.B.1	Stakeholder Group established.	Jan 09	Apr 09	EAAP
M.B.2	Project website set up.	Feb 09	Feb 09	EAAP
M.B.3	E-learning materials available on website.	Nov 09	Nov 09	EAAP
M.B.4	Report of International workshop / Symposium (website based).	Nov 09	Nov 09	EAAP

SUBPROJECT 1: ALTERNATIVES TO PIG CASTRATION

WP 1.1. Alternatives to surgical castration

Work package objectives

This work package had the following objectives:

- 1.1.1. To investigate husbandry and management conditions enabling reduced incidence of boar taint and improved animal welfare and health status
- 1.1.2. To investigate the distribution of alleles and expression of key genes regulating the level of boar taint related compounds in various entire male pig breeds
- 1.1.3. To investigate carcass and meat quality characteristics other than boar taint

Progress towards objectives

Four tasks were performed within WP1.1:

- Task 1.1.1. Observations in commercial farms
- Task 1.1.2. Experimental approaches of husbandry and management conditions
- Task 1.1.3. Frequency of alleles' distribution and expression of key genes controlling skatole and androstenone deposition in various breeds
- Task 1.1.4. Carcass and meat quality in entire and immunocastrated male pigs

Task 1.1.1: Observations in commercial farms [IFIP, IRTA, ALP]

(detailed description available in Deliverable D.1.1.1)

Objectives (within Objective 1.1.1):

- to ascertain the situation in commercial farms in France and Spain regarding the incidence of boar taint and the welfare of entire male pigs
- to identify differences in genotypes and husbandry practices which could be related to differences in animal welfare status and incidence of boar taint
- to provide characterised samples for other tasks in the project

Description of work performed

IFIP in France and IRTA in Spain produced a total of 488 entire male pigs in 9 farms (347 pigs in 6 farms in France; 141 pigs in 3 farms in Spain).

In each farm the behaviour of the animals during rearing was observed, using the tools defined in the EU project Welfare Quality®.

At slaughter:

- Ear samples were taken from the pigs produced in France and sent to INRA (Toulouse) for DNA extraction and allele frequency analysis (Task 1.1.3 within this WP);
- Liver samples were taken from the pigs produced in France and sent to UWE for gene expression analysis/ (Task 1.1.3 within this WP);
- Fat samples were taken at slaughter and analysed for androstenone and skatole. All measurements were all performed by participant 11 (ALP), and the results were expressed as µg per g melted fat;

- Meat samples were taken at slaughter and provided to WP 1.3 for consumer evaluation. The androstenone and skatole levels of these samples, measured as described above were communicated to WP 1.3.
- Meat samples were taken at slaughter and provided to WP 1.3 for consumer evaluation. The androstenone and skatole levels of these samples, measured as described above were communicated to WP 1.3.

Results

On farm welfare assessment

The frequency of mounting behaviour was low and varied a lot from one farm to another. The highest occurrences of this behaviour were in general due to a limited number of males that made a lot of attempts. This behaviour resulted in some disturbance in the pen.

In general, males were less reactive to the presence of the observer. This may explain why they were less active than the females and spent more time resting during the periods of observation. Once disturbed, they returned more rapidly than females to a resting posture.

Raising males up to this age did not result in more problems than the farmers usually meet with other pigs (castrated males).

Androstenone and skatole levels

The proportion of entire male pigs exhibiting skatole levels higher than 0.2 µg/g melted fat is quite low (4 % in total) but it can differ a lot between farms. The threshold limit for the perception of androstenone being less well established, it is more difficult to conclude on the proportion of animals at risk for androstenone-related boar taint. With a threshold limit of 1 µg/g, 24 % of the entire males could be considered as at risk for androstenone-related boar taint. There is however some evidence from the results of WP-1.3 within this project that the threshold for androstenone perception might be substantially higher. With a threshold limit of 2 µg/g, 7 % of the entire males could be considered as at risk for androstenone-related boar taint. Taking the 0.2 µg/g perception threshold for skatole and the 2.0 µg/g (respectively 1.0 µg/g) threshold for androstenone the proportion of animals at risk for boar taint would be 10% (respectively 25%). These figures should however be considered with caution, because the low number of animals and farms is not fully representative for the whole countries.

Task 1.1.2: Experimental approaches of husbandry and management conditions

[ANIMALIA, INRA, IRTA]

(detailed description available in Deliverable D.1.1.2)

Objectives (within Objective 1.1.1):

To analyse the effect of husbandry and management factors affecting animal welfare status and boar taint levels. The investigated factors include type of housing conditions, social groups and strategy for slaughter.

Description of work performed

The work was divided into three subtasks:

- Subtask 1.1.2.a. Housing conditions [INRA]
- Subtask 1.1.2.b. Social groups and strategy for slaughter [Animalia]
- Subtask 1.1.2.c. Housing conditions and slaughter strategies [IRTA]

In all three studies, the animals were observed during fattening, using a protocol that was harmonised between the three studies and based on the tools defined in the EU project Welfare Quality®. Additional observations for behaviour and skin lesions were realized in experiments a and b. Samples of saliva (experiments a and c) and blood (experiment a) were collected for physiological and immune measurements. At slaughter, the animals were observed for behaviour in experiment b. Carcass and meat quality measurements, including androstenone and skatole levels were performed at or after slaughter.

Subtask 1.1.2.a. Housing conditions

Four groups of males were compared between 30 and 110 kg:

- entire males raised on conventional slatted floor (0.8 m² per pig);
- entire males raised in an enriched environment (1.3 m² per pig indoor on deep litter plus 1.1 m² per pig outdoor on solid floor)
- castrated males raised on slatted floor (0, 8 m² per pig);
- castrated males raised in an enriched environment (1.3 m² per pig indoor on deep litter plus 1.1 m² per pig outdoor on solid floor).

Subtask 1.1.2.b. Social groups and strategy for slaughter

A total of 254 animals were included in the study, distributed to 30 pens (entire male groups - 11 pens, female groups – 8 pens, sibling groups – 11 pens). In four of the pens in each group, all animals were slaughtered at the same day when reaching a certain average live weight. In the rest of the pens, the animals were slaughtered when the individual live weight reached a certain live weight (split-marketing).

Subtask 1.1.2.c. Housing conditions and slaughter strategies

A total of 144 pigs (entire males and females) were kept in groups of 12 allowing or not visual contact between males and females. In half of the pens in each group, all animals were slaughtered at an average pen weight, whereas in the rest of pens split marketing was carried out.

Results

Housing conditions seemed to have a moderate effect on male pigs. Enriched environment can improve the welfare in both males and castrates by reducing the frequency of skin lesions and probably also the level of chronic stress but do not seem to influence sexual development (Experiment a).

Although the results indicated more aggressive and sexual behaviour in entire males, there were no clear differences in skin lesions or cortisol levels between the sexes when measured at the farms. Eye contact with females during fattening did not have an effect on testis weight. Animals in the split marketing group had heavier testis than males that was slaughtered penwise in experiment b, but not in experiment c. However, males having eye contact with females and submitted to split marketing had heavier bulbourethral glands than the three other groups of males (experiment c). A corresponding effect on androstenone level could however not be shown in the first analyses (other measurements in progress).

Results from the recordings at the slaughter house indicated that both sex and slaughter strategy affect aggressive and sexual behaviour at the slaughter house, as well as the score for skin lesions, with highest frequency in males in the split marketing group (experiment b). On the other hand, split marketing had no clear effect on behaviour and skin lesions in the fattening unit. It had no effect on androstenone and skatole levels at slaughter (experiment b).

The data from experiment a) demonstrated, for the first time to our knowledge, a positive influence of the testicular hormones on some parameters of the immune system in pigs.

Task 1.1.3: Frequency of alleles distribution and expression of key genes controlling skatole and androstenone deposition in various breeds [UWE, INRA]

(detailed description available in Deliverable D.1.1.3)

Objectives (Objective 1.1.2):

To investigate the distribution of alleles and expression of key genes regulating the level of boar taint related compounds in various entire male pig breeds.

Description of work performed

Subtask 1.1.3.a. Allele frequency of genes regulating fat androstenone levels [INRA]: The frequency of the T allele in gene 73 (located on SSC 7) has been measured in 298 Large White pigs from SUISAG (Switzerland) and in 347 pigs from IFIP in France (provided by task 1.1.1 within this WP). The results were related to fat androstenone and skatole levels.

Subtask 1.1.3.b. Expression of key genes regulating fat androstenone and skatole levels: The expressions of CYP2E1 (key enzyme degrading skatole) and 3 β -HSD (key enzyme degrading androstenone) in the liver were measured in 16 animals from 'P' breed, 13 'Du x P' and 14 'LW x P' from the IFIP study (Task 1.1.1 within this WP). The results were related to fat androstenone and skatole levels.

Results

The present study met the objectives specified in the project. Breed-specific variations in the expression of skatole-metabolizing enzymes might contribute to breed-specific mechanisms controlling deposition of skatole. The mutation in the gene '73' (T allele) is associated with a low level of androstenone in fat which might be due to activation of the hepatic androstenone degradation or inhibition of the testicular androstenone synthesis.

More specifically, it was established:

- Between-breed variations in the expression of the skatole- and androstenone-metabolizing enzymes (CYP2E1 and 3 β -HSD respectively) in pig liver.
- Negative relationship between CYP2E1 protein expression and back fat skatole level in 'Du x P' and 'LW x P' but not in 'P' pigs.
- No significant relationship between 3 β -HSD protein expression and subcutaneous fat androstenone content.
- Negative relationship between the frequency of the T allele in the gene '73' and androstenone level in pig populations from Switzerland and France.
- The relationship between the T allele frequency and androstenone level is closer in the 'LW x P' than in the 'P' pigs.

Task 1.1.4: Carcass and meat quality in entire and immunocastrated male pigs [ALP]

(detailed description available in Deliverable D.1.1.4)

Objectives (Objective 1.1.3):

To investigate carcass and meat quality characteristics other than boar taint.

Description of work performed

The work performed includes:

- conducting an experimental study to investigate whether fat composition of immunocastrated pigs can be modulated by specific feeding strategies
- building a database containing available information regarding carcass and meat quality traits in entire and immunocastrated pigs. Twenty eight studies were included
- performing a meta analysis of the information contained in the database. The aim was to compare the impact of lack of castration or immunocastration on meat quality traits, which are not related to boar taint but are known to affect consumer acceptance

Results

The leaner carcasses of immunocastrated pigs (IC) compared to barrows resulted in a more unsaturated adipose tissue. However, the fatty acid composition of the adipose tissue could be adjusted through applying a specific feeding strategy where diets containing less unsaturated fatty acids are provided to the animals.

From the meta-analysis of 28 studies included in the database, it appears that carcasses of entire males (EM) are leaner and exhibit lower intramuscular fat content of the LD than castrates (C), immunocastrates (IC) and female (F) pigs. Shear force is higher in EM in comparison to C, IC and F; however, sensory tenderness and sensory juiciness are not affected by castration method and sex. The lack of homogeneity of the effect sizes across the studies indicates that these findings may not yet be extended to the whole pig populations without care.

The present study revealed that in the current situation, the implementation of IC and EM production should not be hindered by major meat quality concerns. Furthermore, replacing C by EM or IC will result in a greater homogeneity of carcasses at the slaughterhouse, as shown by the very small effect sizes between EM and F. However, the accentuation towards leaner carcasses and lower intramuscular fat content bears some danger as this could ultimately lead to deviations in meat quality such as tenderness and juiciness especially in pig populations with already low intramuscular fat content.

Deviations from the project work programme and corrective actions taken

Task 1.1.1. Observations in commercial farms:

No significant deviation

Task 1.1.2. Experimental approaches of husbandry and management conditions

Behaviour data not yet analysed in subtask 1.1.2c. Should be available by January 2010.

Task 1.1.3. Frequency of alleles distribution and expression of key genes controlling skatole and androstenone deposition in various breeds

No significant deviation

Task 1.1.4. Carcass and meat quality in entire and immunocastrated male pigs

No significant deviation

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.1.1.1	A report on the incidence of boar taint in commercial farms in France and Spain and on observed differences in androstenone and skatole levels between breeds and husbandry practices	Oct 09	Nov 09	IFIP
D.1.1.2	A report on the experimental approach of the effect of husbandry and management conditions on aggression and mounting behaviour and on boar taint levels	Oct 09	Nov 09	ANIM.
D.1.1.3	A report describing breed-specific expression of key skatole and androstenone metabolising enzymes and their relation to skatole and androstenone levels in adipose tissue	Oct 09	Nov 09	UWE
D.1.1.4	A report on the meta-analysis of available results regarding meat quality of entire and immunocastrated male pigs	Oct 09	Nov 09	ALP

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.1.1.	Guidelines for Tasks 1.1.1 and 1.1.2	Jan 09	Jan 09	ANIM.
M.1.1.1-1	Slaughter of the animals from the commercial farms	Mar 09	Mar 09	IFIP
M.1.1.1.-2	Levels of skatole and androstenone available from commercial farms	Aug 09	Aug 09	IFIP
M.1.1.2-1	Slaughter of the animals for the experimental approach	Jun-Jul 09	Jun-Jul 09	ANIM.
M1.1.1.2-2	Skatole and androstenone in pigs from the experimental approach	Aug-Sept 09	Aug-Sept 09	ANIM.
M.1.1.3-1	Allele frequencies and enzyme expression	Sept 09	Sept 09	UWE
M.1.1.4-1	Experiment on immunocastrated pigs completed	Apr 09	Apr 09	ALP
M.1.1.4-2	Structure of the data base is discussed and defined	Jun 09	Jun 09	ALP
M.1.1.4.-3	Data from the present project and from the literature are available	Aug 09	Aug 09	ALP

Perspectives and needs for future research

It is important to improve management and environment to ensure that good **animal welfare** is maintained if converting to entire male pig production. This seems to be especially important concerning slaughter strategies, since transport and lairage are shown to be the points most exposed to problems related to increased aggressive and sexual behaviour. Systems that could reduce the need for mixing of unfamiliar pigs during these situations will be beneficial for pig production in general, but is especially important concerning slaughter of entire male pigs.

Results from the project have shown huge herd variations, both regarding **androsthenone and skatole levels** and **behaviour**. An epidemiological study including a sufficient number of farms would be desirable to rule out possible management factors that influence these parameters.

In the present project we have established breed-related variations in the relationship between (i) frequency of the T allele in the gene '73' and **androsthenone level** and (ii) expression of the hepatic CYP2E1 protein and backfat **skatole level**. These are important findings and they contribute to the development of breed-specific biomarkers and/or genetic tests for predisposition to boar taint. The next stage is elucidating the mechanisms underlying the above breed-specific variations and testing the candidate genes for boar taint in larger populations. It is now clear that the causative mutations are not in the actual genes involved in biosynthesis or degradation of skatole and androsthenone, but it likely to be in the transcription factors regulating expression of these genes.

More specifically it would be useful to:

- Confirm if the results of the small number of farms included in the study are representative of the overall situation in these two countries, taking into account that the differences between farms as shown in this study can be very important.
- Develop research to better understand the origin of the variations between farms regarding skatole, androsthenone and welfare parameters, relative influence of the genotype and of the environment, how they interfere?
- Analyze if other management techniques (i.e. feeding strategies), genetic selection and detection methods could be combined with the social management evaluated in the present studies to guarantee good welfare for entire males and a low risk of boar taint.
- Confirm and analyze the role of social regrouping during rearing, transport and lairage on welfare in both males and females. This would be of special interest in pigs meant to be slaughtered at heavy weight, when welfare problems and boar taint risk could be higher.
- Develop better slaughter strategies, minimizing the need for mixing of animals
- Confirm and analyze the role of sexual hormones on the immune system
- Elucidate the physiological pathway linking the gene '73' (which is one of the transcription factors) to the regulation of skatole and androsthenone metabolism
- Elucidate the breed-specific mechanism regulating expression of skatole- and androsthenone-metabolizing enzymes.

WP 1.2. Methods to detect boar taint at the slaughter line

Work package objectives

This work package had the following objectives:

- 1.2.1. To develop rapid detection systems for on-line sorting of boar tainted carcasses to be used in abattoirs.
- 1.2.2. To harmonise existing standard analysis of androstenone, skatole and indole.
- 1.2.3. To develop a programme establishing a European harmonized method to detect boar taint at the slaughter line under commercial conditions. To develop a program for commercialization of new developed on-line detection systems.
- 1.2.4. To organise industry-orientated international workshop.

Progress towards objectives

Four tasks were performed within WP1.2

Task 1.2.1. To develop sensors for simultaneous (or parallel) on-line skatole and androstenone detection in solid phase (fat)

Task 1.2.2. To develop methodology for on-line detection of boar taint compounds in gas phase

Task 1.2.3. To harmonise existing reference methodology for androstenone, skatole and indole analyses

Task 1.2.4. To organize an international industry-orientated workshop

Task 1.2.1. To develop sensors for simultaneous (or parallel) on-line skatole and androstenone detection in solid phase (fat) (UWE)

(detailed description available in Deliverable D.1.2.1)

Summary of work performed and main results:

The aim of this task was to develop androstenone and skatole sensors for detection of these compounds in solid phase (fat).

Work on androstenone sensor:

The feasibility of various approaches (direct oxidation/reduction and electrocatalytic voltammetry) was evaluated for the development of the androstenone sensor.

It was demonstrated that by using cycling voltammetry measurable responses at 0.1 mM androstenone can be obtained.

It was established that electrocatalysis via an electron mediator contained within the working electrode enhances the signal at such concentrations.

Further studies are required to improve the sensitivity of the method.

Work on skatole sensor

Cyclic voltammetry was employed for the development of skatole sensor.

A measurable oxidation peak was established at approximately +0.65 V.

A linear relationship was found between the magnitudes of the oxidation peak over a wide range of skatole concentrations. The limit of skatole detection (10 μ M) was close to the concentrations of interest for boar taint.

Conclusions: It was demonstrated the feasibility of direct electrochemical analysis for measuring of skatole and androstenone. The techniques used in both analyses were relatively simple to integrate with commercial instruments when compared to alternative methods. Materials used in the production of the sensors were commercially available and potentially represent a cost-effective solution to measuring boar taint at all levels of pig-meat processing.

Task 1.2.2. To develop methodology for on-line detection of boar taint compounds in gas phase (NOFIMA)

(detailed description available in Deliverable D.1.2.1)

Summary of work performed and main results.

The aim of this task was to develop a skatole and androstenone detecting technology in gas phase.

Different sampling strategies with the FTIR-PF technique were employed.

Both static and dynamic headspace conditions were evaluated for gas-phase skatole and androstenone analyses.

The feasibility of the use of trained insects (wasps: *Microplitis croceipes*) for determining gas-phase concentrations of skatole, indole and androstenone was also evaluated. It was also established that the gas phase concentrations perceived by the wasps at room temperature varied in the range from 0.5 to 3 ng for indole, skatole and androstenone.

Conclusions: The results with trained insects (wasps) indicated that they showed different thresholds of perception for indole and skatole.

Task 1.2.3. To harmonise existing reference methodology for androstenone, skatole and indole analyses (NOFIMA)

(detailed description available in Deliverable D1.2.4 & D.1.2.5.)

Summary of work performed, main results and conclusions.

It was collected and reviewed: (i) published literature on skatole and androstenone analyses methodology; (ii) legislations related to the boar taint issues.

Reports including conclusions, recommendations and future harmonization strategies were produced.

An inter-laboratory comparison study on pure fat samples according to official guidelines was conducted involving 11 laboratories in different European countries. The inter-laboratory study was based on HPLC, GC, colorimetric and immunological methods. Samples were spiked with known concentrations of indole, skatole and androstenone. Statistical analyses of the data showed significant variations in the results depending on the method and laboratory. This demonstrated the need of a large scale comprehensive study on harmonization and standardization of the existing methods.

A research programme for harmonized boar taint detection methodology was produced.

Task 1.2.4. To organize an international industry-orientated workshop (NOFIMA)
(detailed description available in Deliverable D. 1.2.6)

Summary of work performed, main results and conclusions:

An International Boar Taint Detection Workshop was organized and held in Bologna, Italy on 28 October 2009. The Workshop involved participants from academic institutions, industry and stakeholders. Twelve invited speakers presented (i) critical review of traditional methods and related issues; (ii) the need for harmonization and standardisation of skatole and androstenone-detecting methods and (iii) gave an overview of on-going research on novel methodology for boar taint detection. During the workshop there were group discussions which identified the industry need and specifications for skatole– and androstenone– detecting technologies; the industry view on carcass-sorting criteria and harmonization study; (iv) stimulated dialog and integration between the industry and researchers.

Deviations from the project work programme and corrective actions taken

Task 1.2.1. To develop sensors for simultaneous (or parallel) on-line skatole and androstenone detection in solid phase (fat)

No significant deviation

Task 1.2.2. To develop methodology for on-line detection of boar taint compounds in gas phase

Some of the planned tests in the Task 1.2.2 (detection methods using trained insects) were delayed due to technical difficulties encountered during the quantitative gas phase analyses. However the analyses were completed by the end of the project and were included in the final report.

Task 1.2.3. To harmonise existing reference methodology for androstenone, skatole and indole analyses

The leader of the Task 1.2.3 (S. Ampuero, AGROSCOP) withdrawn from leadership and J.E. Haugen (NOFIMA) was nominated (by WP leader O. Doran) and approved (by the project leader MA Oliver) as the Task 1.2.3 manager. The task-leader substitution was done immediately after S. Ampuero withdrawal and did not affect the task performance.

It was originally planned to organize a workshop on boar taint detection technologies and to discuss the reference methodology for boar taint in Switzerland by month 4 (April 09). However, because of time-restrictions for organizing such a meeting at that early stage of the project and after discussion at the kick-off meeting in Brussels (January 2009), it was decided to have 2 parallel workshops followed by an International conference in Bologna in October 2009. This was also agreed and approved with SANCO.

Task 1.2.4. To organize an international industry-orientated workshop

No significant deviation

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.1.2.1	Technical description of skatole and androstenone sensor prototypes	Nov 09	Oct 09	UWE, NOFIMA
D.1.2.2	Report on on-line methods for skatole and androstenone detection	Nov 09	Nov 09	NOFIMA
D.1.2.3	Programme for future research on on-line methods and commercialisation of available and newly-developed skatole and androstenone sensors	Nov 09	Nov 09	UWE
D.1.2.4	Recommendations for harmonised analyses of skatole, indole and androstenone	Nov 09	Oct 09	NOFIMA
D.1.2.5	Programme for research on harmonisation of boar taint detection methodology	Nov 09	Oct 09	NOFIMA
D.1.2.6	Report of the International industry-orientated workshop on on-line detection methodologies.	Nov 09	Nov 09	NOFIMA

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.1.2.1	Developing of skatole and androstenone sensors	Nov 09	Oct 09	UWE, NOFIMA
M.1.2.2.	A scientific report on boar taint compound detection methods	Nov 09	Nov 09	NOFIMA
M.1.2.3-1	International industry-orientated workshop on on-line detection methodologies	Apr 09	Oct 09	NOFIMA
M.1.2.3.-2	Report with recommendations for future research on on-line detection methods	Oct 09	Nov 09	UWE, NOFIMA
M.1.2.3-3	Programme and recommendations for commercialisation of the newly-developed on-line detection methods	Aug 09	Nov 09	UWE, NOFIMA
M.1.2.4-1	A working meeting on harmonization of skatole, indole and androstenone detection procedures	Nov 09	Nov 09	UWE, NOFIMA
M.1.2.4-2	Comparative analyses of skatole, indole and androstenone by two traditional techniques	Nov 09	Oct 09	UWE, NOFIMA
M.1.2.5	Report on harmonization of boar taint detection methods	Nov 09	Oct 09	UWE, NOFIMA

WP 1.3. Demand and acceptance of consumers

Work package objectives

This work package had the following objectives:

- 1.3.1. Harmonization of consumer research
- 1.3.2. Analysis demand and acceptance of consumers
- 1.3.3. To identify consumer differentiations among countries and regional differences in Europe depending on production system and meat product requirements.

Progress towards objectives

Six tasks were performed within WP1.3:

- Task 1.3.1 Development of a harmonized protocol for sensorial analysis based on the inventory of different methods used in the past in different countries (G.Tackén)
- Task 1.3.2 Development of pre and post-phase questionnaires for attitudes and consumer tests (G. Tackén)
- Task 1.3.3 Attitudes in different EU Member States (J.M. Gil)
- Task 1.3.4 Consumer test in different EU Member States (G.Tackén)
- Task 1.3.5 Analyses of the data from attitudes in different EU member states (M. Font i Furnols)
- Task 1.3.6 Analyses of the data from the consumer survey in different EU member states (G.Tackén)

First of all, a harmonized protocol for sensorial analysis was done (Task 1.3.1.). All parties involved had already experience on country consumer studies on boar taint, with different protocols and objectives in the past. The objective in this work package was firstly to harmonize the activities to one protocol that would give the insights required by the Commission and that would be feasible in all the countries. At the same time, a pre- and a post- questionnaires for attitudes and consumer test were done (Task 1.3.2.).

Secondly, the harmonized protocols of attitudes (Task 1.3.3.) and sensory tests were implemented (Task 1.3.4.). The consumer tests were performed in six countries around Europe (France, Germany, Italy, the Netherlands, Spain and the UK), 130 consumers per country. In the implementation of the research protocol everything was done according to the protocol. These consumers first had to fill out a questionnaire about the relative importance of animal welfare and their attitude towards pig castration. After that, the same consumers were invited to test, blindly, three types of loin (gilt meat, boar meat with boar taint and boar meat without boar taint) in a sensory room. After this test the same consumers were invited to the kitchen to smell loin with boar taint during preparation. Afterwards some questions were asked about the meat that was prepared. Eventually, after all these sense and taste experiences some of the attitude questions were asked again. The main results of these tests are presented below.

Task. 1.3.5. Analyses of the data from attitudes in different EU member states

(detailed description available in Deliverable D.1.3.3.& D.1.3.4.)

One of the objectives of this workpackage was to find out consumer attitudes towards animal welfare and how these are related to other factors in the buying decision. Table 1 shows the main results on buying factors for pork meat.

Table 1.3.1 Relative weight of buying factors for pork meat in the different countries

Buying factor	Country					
	FR	GE	IT	NL	SP	UK
Expected taste and odour	0.40	0.42	0.43	0.40	0.57	0.43
Price	0.27	0.27	0.18	0.33	0.21	0.27
Origin (total)	0.27	0.25	0.31	0.17	0.16	0.20
- National	0.23	0.20	0.25	0.13	0.14	0.15
Animal welfare (total)	0.06	0.07	0.08	0.10	0.06	0.10
- Entire male	0.02	0.02	0.02	0.02	0.02	0.03
- Castrates with anaesthesia	0.01	0.02	0.02	0.04	0.01	0.02
- Castrates without anaesthesia	0.01	0.01	0.01	0.02	0.01	0.02
- Female	0.02	0.02	0.03	0.02	0.02	0.03

Table 1.3.1 shows that the expected taste and odour were the most important aspects that consumers take into account when buying meat. In most of the countries, price of the meat was the second aspect that is taken into account, apart from Italy where origin was the second most important buying factor. Origin was in all other countries the third factor and in Italy price was the third factor. Animal welfare was in all countries the least buying factor considered by the consumer. In most countries respondents preferred females and entire males as type of meat, with the exception of the Netherlands where the first preference was for castrates with anaesthesia.

The methodology of the consumer research was chosen in such a way that the acceptance test, which was carried out between the pre and the post test, could determine consumer's attitudes. Therefore, the pre-test measured the pure attitudes and the post test measured the consequences of tasting tainted meat. The attitude of consumers before tasting the meat with boar taint is compared with the attitude afterwards. By conducting this experimental design it was found that that animal welfare perception increased after consumers tasted the meat. After tasting the meat, the following preferences were found in the following countries:

- Spain: females and entire males
- France: castrates with anaesthesia and entire males
- United Kingdom: entire males and females
- Netherlands: castrates with anaesthesia
- Germany: females
- Italy: castrates without anaesthesia

Task. 1.3.6. Analyses of the data from the consumer test survey in different EU member states

(detailed description available in Deliverable D.1.3.4.)

Another objective was to find out whether consumers accept meat with boar taint or not Table 1.3.2 presents consumers' perception of differences between boar meat with and without boar taint in relation to gilts and in relation to each other.

Table 1.3.2 Perception differences between gilt, boar meat with and without boar taint.

Country	Det+ and Gilt	Det- and Gilt	Det+ and Det-
France	Yes	No	Yes
Italy	Yes	No	Yes
Germany	No	Yes	Yes
The Netherlands	Yes	Yes	No
Spain	No	Yes	Yes
United Kingdom	No	Yes	Yes

Test: Paired sample t-test, significant differences ($p < 0.1$)

Table 1.3.2 shows that only in France, Italy and the Netherlands significant differences were found between the consumer perception of tainted boar meat and gilt meat. This can be explained by the fact that in Spain and the UK tainted boar meat with relatively low androstenone and skatole levels was used. Despite high values of androstenone and skatole, the German rates showed no significant differences. Only in the Netherlands no significant differences were found between tainted boar meat and boar meat without boar taint. This would imply that in most countries with high androstenone and skatole levels (respectively $>2 \mu\text{g/g}$ and $>0.15 \mu\text{g/g}$) consumers could perceive differences.

During preparation of meat, boar taint is best perceptible. Therefore consumers were invited into the kitchen while a cook or researcher was preparing meat with boar taint. Table 1.3.3 presents the percentages of consumers who think the odour was normal or abnormal.

Table 1.3.3 Percentage of consumers who perceive the odour of tainted meat as normal or abnormal during the kitchen test.

Country	N	Normal	Abnormal
France	117	77%	33%
Italy	139	58%	42%
Germany	107	57%	43%
The Netherlands	116	52%	48%
Spain	136	90%	10%
United Kingdom	147	72%	28%

Table 1.3.3 indicates that most consumers think that the meat had a normal odour during the kitchen session. In the countries with lower androstenone and skatole levels (Spain and the UK) this percentage was even higher. It is striking however that in France a very high percentage of the consumers thought the odour was normal, while the same meat was used in the sensory test.

Both groups of consumers were asked about what they would do with the meat if they perceived the same abnormal odour on meat at home. The results of that test are presented in Table 1.3.4.

Table 1.3.4. Serving and purchasing behaviour for consumers that perceive an abnormal odour in the meat.

Country	N	Serve the meat yes	Repurchase pork Yes	Revisit shop Yes
France	39	36%	44%	44%
Italy	57	49%	60%	39%
Germany	46	26%	46%	46%
The Netherlands	56	45%	55%	66%
Spain	14	46%	50%	50%
United Kingdom	41	73%	49%	78%

Table 1.3.4 shows that 25 to nearly 50% of the consumers who smell an abnormal odour would still serve the meat to their family members. Forty to 56% of the consumers would not purchase pork meat for a while in case the meat would have a smell like that. And 22 to 61% would blame the store in case meat like this would be sold. This means that stopping castration in a short period time, while the detection methods are not reliable, could lead to negative consequences on the demand for pork meat and/or on the image of the retailer who sells the meat.

In conclusion, there are some differences in preferences between countries with respect to animal welfare of pigs, but the differences in acceptance seem to be more related to the characteristics of the meat than to differences between countries. The differences in attitudes towards animal welfare are however more country related. In the Northern-Western countries there is more attention to animal welfare and in the southern countries there is more attention to expected taste.

Deviations from the project work programme and corrective actions taken

In the Netherlands, in a first instance a mistake was made in the randomization of the attitude questionnaire. This was repaired afterwards in a new fieldwork.

Due to practical reasons in the Netherlands both the human selection of meat with boar taint and the chemical approach were used. This meat was used for the research in the Netherlands and Germany. In all other countries only the chemical approach was used.

In French database, no link between the androstenone and skatole levels and consumer test could be made. Therefore in the explanation of the French results, no connection with respect to androstenone and skatole levels could be done. For all other countries this connection was made.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.1.3.1	Report of harmonized protocol for sensorial analyses	Mar 09	Mar 09	LEI
D.1.3.2	Pre and post phase questionnaires for consumer tests translated in language of countries participating	Feb 09	Feb 09	LEI
D.1.3.3	Preliminary test report on attitudes in Europe	Apr - May 09	May 09	LEI/CREDA
D.1.3.4	Final report on attitudes and acceptability with identification of potential differences among consumers/country and region	Nov 09	Oct 09	LEI/CREDA IRTA/CRPA IFIP

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.1.3.1	Harmonized protocol and pre and post phase questionnaire	Mar 09	Mar 09	LEI
M.1.3.2	Results of consumer test (end of all test)	July 09	May 09	LEI
M.1.3.3	Draft version of report on consumer tests	Sept 09	Sept 09	LEI CREDA IRTA
M.1.3.4	Final version on report on consumer tests	Nov 09	Nov 09	LEI/CREDA/ IRTA/CRPA/ IFIP

Perspectives and needs for future research

As meat with boar taint is detected by consumers (as an abnormal odour), stopping castration can have drastic consequences in the pig chain unless a good detection method is previously developed.

Therefore more research is necessary on the following points:

- To develop harmonization studies to determine precisely the threshold levels for boar taint detected for consumers in different countries (EU and possible markets- importing countries).
- Large scale study of preferences and behaviour of European consumers in relation to fresh pig meat products (in addition to the loin) and cured or smoked products from entire males and females. This study should be performed in collaboration of end-users like consumer associations and retailers of different Eastern, Southern, Western and Northern countries.
- Research for specific consumers markets for pig meat from entire males within EU and in importing markets such as Asia.

WP 1.4. Economic assessment of pig meat chains without surgical castration

Work package objectives

This work package had the following objective:

- 1.4.1. To combine the expertise from WP1.1, WP1.2, and WP1.3 by developing and evaluating a computer-based optimization model that allows for identifying cost-effective combinations of measures throughout the pork supply chain (genetics, farm management, on line detection) to enable fattening entire male pigs.

Progress towards objectives

Two tasks were performed within WP1.4:

Task 1.4.1. To model the costs and benefits of fattening entire males for pork supply chains in selected countries (G. Backus).

Task 1.4.2. To collect available model parameters, based on existing data and results of WP1.1, WP1.2 and WP1.3 (N. Valeeva).

Task 1.4.1 To model the costs and benefits of fattening entire males for pork supply chains in selected countries.

(detailed description available in Deliverable D.1.4.1.)

Objectives

The objective of this study was to review important issues in boar taint prevention without surgical castration from the pork production chain perspective.

Description of work performed

Firstly, a literature review on alternatives to surgical castration was performed. Specifically, alternatives to surgical castration, factors influencing boar taint development and economic considerations associated with the presently feasible alternatives to surgical castration were reviewed. The model development includes three basic steps. The first step identifies specific control measures for preventing boar taint in the chain. Few factors were excluded from consideration due to lack of exact information (or absence of any significant effect) on any of the boar taint substances. The second step deals with the quantification of effectiveness of control measures at preventing boar taint, i.e. concentrations of boar taint compounds such as androstenone, skatole and indole. The obtained data are used as the input for the pilot chain model for evaluating the cost-effectiveness of different alternatives to surgical castration. Only decreases of boar taint compound concentration in subcutaneous fat (not in blood or urine) are considered as effect. This basic situation is defined by the levels of boar taint compounds associated with implementation of the most typical practice while raising entire males, i.e. when castration of male piglet is not a practice anymore. So, for each factor, chain participants must decide which control measure to implement in order to decrease the levels of boar taint compounds, compared to the basic (effect) situation. The third step in model development evaluates costs of control measures throughout the whole pork chain in Euros per kg slaughter weight. The partial budgeting technique was used. Additional control costs to reduce boar taint relative to the measure representing the basic situation were calculated; assuming that implementation of all changes is feasible. A detailed economic calculation model was specified

in a Microsoft Excel spreadsheet for each country. The obtained economic data are used as inputs for the pilot chain model for evaluating the cost-effectiveness of different alternatives to surgical castration.

Data on costs of control measures were collected. The data were mainly obtained from published studies, national handbooks and reports. Also, pig husbandry researchers and representatives of compound feed companies and slaughterhouses were interviewed to obtain data needed to calculate the costs. The cost estimates are considered representative of the typical conventional Dutch, French and Italian pig-fattening farms (close to an average farm size) with mixed-sex rearing (i.e. 50% male pigs and 50% female pigs) and slaughterhouses.

Results

The existing studies on alternatives to surgical castration do not take into account all the identified pros and cons of raising boars. And although many pros and cons have been discussed in the literature, economic studies on boar production are limited to exploring benefits resulting from better feed conversion, better growth rate and higher carcass leanness. A cost-benefit analysis of alternative measures, with all pros and cons considered, is lacking. It should however be noted that monetary value is not to be easily assigned to all (dis)advantages.

The literature review concludes that prevention of boar taint is a challenge and task for the entire pork production chain and an integrating approach would be useful to deal with this. In the first place, such an approach would require to fill the identified gaps in scientific knowledge about technical and economical aspects of boar taint prevention in the broader chain context, and provide more insights into consumer acceptance of boar taint.

The contribution of the economic study is to establish the first step in developing an integrated chain model. Specifically, a pilot model for evaluating the cost-effectiveness of different alternatives to surgical castration along the chain is developed. The model is applied for three countries: The Netherlands, France ('genetic selection, altering management strategies and slaughter at a lower weight' scenario) and Italy ('immunocastration' scenario). Next, comparison of economic costs and benefits associated with raising entire males and castrated males is performed at the chain level in the Netherlands and France. Finally, these costs and benefits are compared to costs involved in boar taint prevention.

The model development includes three basic steps. The first step identifies specific control measures for preventing boar taint in the chain. Strategies for reducing boar taint in the pork production chain deal with specific factors that influence androstenone, skatole and indole levels in pigs. These factors refer to genetic selection (pig breeding stage); altering management strategies (pig growing stage); slaughter at younger age and lower weight (slaughtering stage).

A number of corresponding interventions/control measures were designed for each factor; implying that specific control measures can be adopted to have a positive effect of each particular factor on boar taint. Not all identified factors were considered. Only measures that are currently available for adoption, and that comply with existing legislation and follow standard pig husbandry practices are considered. For this reason, the factor 'special diet' (implying a short-term administration of antibiotic additives) or the factor 'floor type in pens and associated pig cleanness' (implying the use of wholly slatted floor) is not considered, although they have a positive effect on skatole and indole reduction. Some other factors known in the literature such as 'extra water supply' (implying extra water supply in the form of an extra nipple drinker) and 'feed strategy for fattening hours' (implying fasting for 12 hours before delivery) are not further considered due to changes in standard pig husbandry that have occurred since the time when some research was performed, sometimes more than 10 years ago. These factors refer to the

current situation (baseline scenario) in the Netherlands. This means that the positive effect of these factors is already included in the current concentration of boar taint compounds. That is, no improvements compared to the basic situation are possible for these factors. Also, the factor 'feed system/dry diets vs. wet diets' (implying the feeding of whey) is not feasible nowadays because dairy industry derives as many components as possible from whey and there is nothing left for use as a feed ingredient.

The quantitative effects of separate control measures on the reduction of concentrations of boar taint compounds are difficult to quantify for one specific country scenario (experiments in the same country, the same methods applied, the same breed and the same slaughter weight, the same experiment conditions such as diets, housing environment, etc.). Therefore, the available knowledge from different studies (when data are available) is used. The expert judgment method is used to obtain data on quantitative effects for the designed (based on the literature) control measures related to feed composition. The exact knowledge from the literature is not generally applicable for any country due to considerable differences in feed diets between countries.

The cost estimates made use of average parameters on meat price, costs related to purchase of piglets and feed, transportation of fattening pigs interest, housing, health care and labour costs. Furthermore, the obtained total additional costs of boar taint prevention are compared with cost and benefits associated with raising entire males compared to castrates. Changes in feed conversion, daily growth, animal health, environmental benefit, costs related to castration as well as price increase for a better carcass quality (leanness) and price reduction for possibly tainted carcasses are taken into account when estimating costs of raising entire males instead of castrates. Cost-effectiveness is expressed as a ratio of change in effect (such as reduction in level of boar taint compounds, i.e. androstenone, skatole and indole) relative to change in costs associated with interventions/control measures implemented.

Task 1.4.2. To collect available model parameters, based on existing data and results of WP1.1, WP1.2 and WP1.3.

(detailed description available in Deliverable D.1.4.2.)

Objectives

This task aims at reporting and discussing the results of an economic analysis of boar taint prevention obtained for three EU countries (The Netherlands, France and Italy).

Description of work performed

Technical data were collected by LEI-WUR, CRPA and IFIP on the relationship between alternative measures (breeding, management and detection) with levels of androstenone, skatole and indole, and the relationship between these levels and the consumer acceptance. Furthermore technical (growth, feed conversion, carcass and meat quality) and economic (pork price payments schemes) data were collected to enable calculating costs and benefits.

The study makes use of the same effect data for the selected countries. These effect data are based on the literature, with exception of the effect data for the control measures related to the factor 'feed composition (both protein and non-starch polysaccharides aspects in the diets)'. The feed compositions considered in this study are designed on the basis of the knowledge from the literature and the knowledge of feed experts. In contrast to the diets available in the literature, these diets are potentially applicable for the Netherlands and France. However, no actual effect data are available for them yet.

Results

Based on the literature study, it seems reasonable to expect an effect of 0.02 mg skatole per kg fat and higher while feeding the designed diets only in the last two weeks before slaughter; whereas it seems less realistic to expect a rather high effect of 0.29 mg per kg fat and higher while feeding the designed diets constantly during the whole fattening period. The obtained economic input data for each country are defined for two possible options of raising entire males in the farm stage: mixed-sex groups rearing (50% boars and 50% gilts) and split-sex rearing (100% boars). For many control measures, the choice between these options makes a substantial difference in extra costs. The control measures relevant to the factors ‘cleanness in the last week before slaughter’, ‘stocking rate’, ‘air temperature during summer’, ‘feed system: dry diets vs. wet diets’ and ‘feed composition (both protein and non-starch polysaccharides aspects in the feed)’ are examples of such measures where extra costs for the split-sex option are about twice as low as extra costs for the mixed-sex option. At the same time, when the split-sex option is to be chosen, the control measure relevant to the ‘stable social groups’ factor, i.e. ‘no mixing of unrelated animals: a strict all-in all-out (‘birth to slaughter’) system’, cannot be implemented. Implementation of certain control measures involves negative costs (i.e. savings). These are control measures related to the factors ‘air temperature during summer’, ‘stable social groups’ and ‘feed system: dry diets vs. wet diets’.

A number of control measures have a negative cost-effectiveness ratio, due to better growth performance of pigs resulting from implementation of these control measures. ‘Keeping boars in rather constant temperature environment (no heat peaks), extra regulation by means of a sprinkler system’ is an example of such control measures, with negative cost-effectiveness ratios of 0.01 and 0.02 (for skatole) for the mixed- and split-sex options, respectively.

In general, the split-sex option of raising entire males is more cost-effective in reducing skatole and indole levels for both countries. ‘Keeping boars constantly in extra clean environment, also in the last week before slaughter is cost-effective for skatole reduction (cost-effectiveness ratios of 0.15 and 0.18 for the Netherlands and France, respectively) and ‘keeping boars at a low stocking rate (ca. 1.0 m²) per animal’ is the most cost-effective for the indole reduction (cost-effective ratios of 0.11 and 0.10 for the Netherlands and France, respectively). At the same time the control measure ‘split-sex groups rearing: boar and gilt in different compartments’ is the most cost-effective for androstenone reduction, with cost-effectiveness ratios of 16.3 and 19.6 for the Netherlands and France, respectively.

The choice for the mixed-sex groups rearing involves implementation of less cost-effective control measures (in terms of the skatole and indole reduction), compared to the split-sex groups rearing. However, such a choice allows for reducing androstenone by 0.13 mg/kg fat per extra saved Eurocent, mainly due to saving on animal health costs.

As for the pig breeding stage, the presented two extreme options of selection pressure differ substantially in their cost-effectiveness, especially for androstenone reduction. The cost-effectiveness ratios for ‘selection pressure on boar taint only (100%)’ and ‘selection pressure on both economics (90%) and boar taint (10%)’ are 0.13 and 1.02, respectively, for the Netherlands. For France, these ratios are 0.14 and 0.94, respectively. The cost-effectiveness ratios for the skatole reduction are much lower for both countries, compared to those for the androstenone reduction (0.02 and 0.13 for the Netherlands and 0.03 and 0.12 for France). These results indicate that the studied breeding programs with the goal of selection on androstenone and skatole are more cost-effective in androstenone reduction than in skatole reductions. Furthermore, the programs that combined selection pressure on both economics and boar taint tend to be much more cost-effective. Combined selection on boar taint and on economics traits

is also much more cost-effective than slaughtering at a lower weight. No major differences in cost-effectiveness of measures are observed between the Netherlands and France.

Table 1.4.1 reports the results of comparing costs and benefits associated with raising boars compared to barrows. The comparison is performed for typical Dutch and French pig-fattening farms with mixed-sex groups rearing. It is assumed that these farms switch to raising boars only, given that none of the – already mentioned - control measures are implemented on the farm to prevent boar taint. The results illustrate that raising boars may be beneficial, due to a better feed conversion ratio. We can also observe that the costs and benefits of raising boars are unequally distributed among the chain segments. Farmers benefit from better feed conversion ratios, and slaughter plants will be confronted with a discount for boar tainted meat. The assumed testing costs and price reduction for boar tainted meat are low, compared to the reduction in feed cost. The price reduction may increase, however, when the majority of European pork producers convert to raising boars.

Table 1.4.1. Costs and benefits associated with raising boars compared to barrows¹⁾

	Netherlands		France	
	Barrows	Boars	Barrows	Boars
Daily growth, g/day	780	801	780	801
Feed conversion ratio, kg/kg	2.70	2.44	2.91	2.65
Piglet price, Euro/piglet	41.92	41.84	46.00	45.94
Feed price, Euro/kg	0.26	0.26	0.24	0.24
Labour costs per fattening pig (Euro)	2.82	2.90	3.03	3.21
Delivery costs per fattening pig per year (Euro)	6.55	6.72	2.54	2.60
Slaughter pig price, Euro/kg slaughter pig	1.506	1.518	1.506	1.518
Testing costs and price reduction for tainted meat (Euro/pig per year)		1.10		1.09
Return per fattening pig per year (Euro) ²⁾	422.03	436.82	432.39	446.83
Extra net return per fattening pig per year (Euro)		24.55		22.61

- 1) Barrows = raising barrows in the basic situation, with mixed-sex groups rearing (i.e. 50% male pigs and 50% female pigs) (50% barrows and 50% gilts); Boars = split-sex groups rearing with only boars on the farm (100% male pigs).
- 2) Price reduction for tainted meat is calculated on the assumption that boar taint incidence is 2% resulting in a lower market value of boar tainted carcasses and additional labour costs of a ‘human nose’ for testing 300 carcasses per hour.

Immunocastration” scenario for Italy

Economic costs and benefits of raising immunocastrated males and surgery castrated males are evaluated in a separate calculation model for the ‘immunocastration’ scenario in Italy. The analysis made use of the findings from the previous studies on economics of immunocastration and performed for typical Italian farms, assuming raising males only. Immunocastration is considered as the second feasible option in this study, specifically for countries with a rather heavy slaughter weight about 160 kg. Italy is one of such countries. In these countries prevention of boar taint only by means of the altering management strategies does not seem realistic at present due to increased androstenone level in pigs of such a weight.

According to the results of these calculations, immunocastrates in Italy have a significant improvement of feed conversion ratio in comparison with surgical castrates (3.96 vs. 4.45 kg/kg). This improvement generates a benefit of 24.74 Euro per fattening pig per year. At the

same time, the total cost of vaccinating the pigs three times involve 8.35 Euro per fattening pig per year, including costs of extra labour. Also, a lower yield at slaughtering accounts for extra costs of 3.23 Euro per fattening pig per year, related to extra time needed to cut off the testicles from the carcasses of immunocastrates. Overall, results show that in Italy immunocastration generates a benefit of 13.16 Euro per fattening pig per year in comparison to surgical castration. However, no difference in boar taint incidence is assumed between castrates and immunocastrates. So, it is assumed that immunocastrates do not cause a significant boar taint problem.

Deviations from the project work programme and corrective actions taken

Scientific reports on the effects of breeding and feeding measures on androstenone, skatole and indole lacked. Results of pure breed lines were used to estimate the effects of breeding measures. For feeding measures an approach was chosen to determine the minimum effect of feeding measures on androstenone, skatole and indole achieve the same level of cost-effectiveness as cleaning measures.

Technical data were to be collected on the relationship between levels of androstenone, skatole and indole, and the consumer acceptance. The results of WP 1.2 and WP1.3 did not provide results clear enough to enable defining threshold values for androstenone, skatole and indole. Corrective action was taken by calculating the cost-effectiveness of reducing these levels, instead of calculating the cost of developing specific threshold values.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.1.4.1	An economic pork supply chain model for the production of entire males	Oct 09	Nov 09	LEI-WUR
D.1.4.2	A report on the economics of pig meat production in different scenario's	Nov 09	Nov 09	LEI-WUR

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.1.4.1	A feasible pork supply chain model to optimize measures aimed at fattening entire males	Sept 09	Nov 09	LEI-WUR
M.1.4.2	An internal report on estimates and sensitivities of the cost and benefits of producing entire males in selected countries	Oct 09	Nov 09	LEI-WUR
M.1.4.3	A report on the economics of pigmeat production from entire males in different scenarios	Nov 09	Nov 09	LEI-WUR

SUBPROJECT 2: ALTERNATIVES TO CATTLE DEHORNING

Introduction

In Europe, there is a growing support by citizens for the development of more welfare-orientated production systems and, therefore, a need to ensure that there are solid scientific data available to underpin policy development.

The general objective of this sub-project of the ALCASDE program was to look in depth into alternatives to the dehorning of cattle in order to evaluate different strategies to promote these alternatives.

To achieve this, we carried out three main actions in this project:

- an analysis of the current situation regarding dehorning in the member states
- a review of the scientific literature and data available on the effect of dehorning and on the alternatives to dehorning i.e. keeping horned cattle or polled cattle
- a proposal for final recommendations and points of action taking into account the opinion of the main stakeholders on the way to improve animal welfare regarding to dehorning

The current situation regarding dehorning (WP 2.1)

A large survey was carried out in the Member States under the responsibility of some partners of ALCASDE Consortium (Deliverable 2.1.1). Contacts were established with local experts from relevant institutions like Universities, National farmers' associations, cattle breeders associations, farm veterinarians and practitioners. In each Member State, specific questionnaires were submitted to experts of three cattle categories: dairy, beef, and suckler herd. After data collection, a quantitative analysis has been carried out in order to produce figures on dehorning practices and on the prevalence of disbudding/dehorning for each cattle category in Europe and in four EU macro-regions (North, Centre, East and South).

At the same time, in order to get a better understanding of the farmers' views towards the disbudding/dehorning methods, the alternatives and their expectation, motivation or proposal, 94 farmers from 3 countries (Italy, Germany and France) participated in 9 focus groups (3 per country – Deliverable 2.1.2). With this sample, we intended to have exchanges with farmers from a large diversity of production system including dairy cows and suckler herd, conventional and organic farms, flat lands and mountain regions.

Based on results obtained during these surveys, it was concluded that keeping hornless adult cattle (dairy or suckle) is the most frequent situation in the Member States (respectively approx 80% and 60 %) and it also leads farmers to different choices in term of housing and management of animal that cannot be easily changed. Fattening beef are less frequently hornless (approx 40 %). The main farmers' motivations to keep hornless cattle are the higher risk and more severe consequences of injuries for themselves or for the animals with horned cattle but other local particularities (i.e. market, breeds...) have also an effect on their choice. Disbudding with hot iron realized by farmers, particularly for dairy cattle, is the most frequent methods but there is obviously a lack of training and difficulties to use pain releaser. Disbudding is preferred by farmer as a less stressful and painful procedure for the animal. At last, if keeping polled cattle would surely be an alternative for farmers when bulls of high genetic quality will be available; these studies also emphasized the need for a freedom of choice between the different alternatives.

Benefits and drawbacks of dehorning and alternatives to dehorning (WP 2.2 and WP 2.3)

Two reviews of scientific and technical publications were carried out on benefits and drawbacks of cattle dehorning/disbudding and their alternatives: keeping fully horned cattle (Deliverables 2.2.1 and 2.3.1) or introducing polled animals (2.2.2). SP2 partners and EAAP Cattle Working Group members were given opportunity to contribute (2.2.1). The stakeholders' views were taken into account by organising a workshop in Bologna the 28th of October 2009 and inviting representatives from veterinarian, breeding companies, farmers association, meat industry and animal welfare organisations.

There is a lack of scientific studies into the relevance of horns for cattle. Arguments for and against dehorning/disbudding relate to human safety, animal welfare, ethics, economics, cultural aspects and product quality. While dehorning has stronger negative welfare effects than disbudding, any method of disbudding/dehorning causes distress and pain, which should be alleviated as far as possible, preferably by a combination of sedation (in animals not used to handling and further research is needed to better evaluate the effect), local anaesthesia and anti-inflammatory treatment (Deliverable 2.2.1).

For keeping fully horned cattle, little number of specific housing and management recommendations are available and further research is needed. However, these recommendations based on scientific studies and practical experiences were synthesised in Deliverable 2.3.1. They emphasize that dimensions of feeding places, of passageways, general space allowances and availability of cubicles should be increased while many other adaptations to the housing conditions are also favourable (e.g., avoiding dead-end situations, use of feed barriers open at the top, cubicles with escape possibilities to the front). Furthermore, the management of situations where there is a high risk of competition (e.g. feeding and of course integration of unfamiliar animals) is a key factor. As these recommendations include higher minimum recommendations than those for hornless cows, keeping horned adult cattle can induce economic losses in combination with higher investment costs and farmers need additional support.

The other alternative to dehorning i.e. introducing polled cattle was assessed in Deliverable 2.2.2. The natural absence of horns is determined by a single gene, with polled (= hornless) being dominant over horned. The frequency of polled varies between breeds from 0 to 100 % and in the main used breeds (i.e. Friesian Holstein or Charolais) a few number of heterozygous bulls are available. Many problems still need to be solved as low breeding values, presence of Scur alleles or negative traits. Classic introgression and breeding programs to increase the frequency and genetic merit of polled animals take long. Computer simulations showed that with the new genomic selection tools, high genetic merit polled bulls can be bred within 10 years.

Consultations showed that farmers (a survey realised in the Netherland which is confirmed by the findings of WP 2.1) are only interested in using polled bulls if they have a high genetic merit, and breeding companies are starting to develop breeding programs in Holstein and Charolais. In German Fleckvieh breeding programs are well under way but some limited negative traits appeared and further investigations are needed to understand whether it is due to inbreeding or linked to the gene.

For most stakeholders, dehorning in itself is not a major ethical issue in itself but reducing pain during disbudding/dehorning is an important objective. It was put forward that there is a balance, in term of welfare, between the risk of injuries of pen-mates or during transport, the way of housing (loose is preferable to tie stall) and the dehorning. Most stakeholders agreed that disbudding young animals with pain releasers (less than 2 months old) is preferable to dehorning.

Polled cattle appeared as the way forward for stakeholders and representative of breeding companies confirmed the availability of polled bulls and the major breakthrough linked to genomic selection. But many of the stakeholders had concerns about the risk that polled cattle would completely replace horned cattle in the future and this might be associated to some detrimental effects. Additionally most stakeholders support the importance of a free choice for farmers to keep horned animals or to use polled animals, so that both options should be available.

Conclusion and final recommendations (Deliverable 2.3.3)

Based on the findings of the project, it was finally recommended to restrict dehorning to emergency cases and to take initiatives to improve disbudding practices especially by better training and enhanced possibilities for farmers to use pain releaser. Keeping polled cattle and keeping horned cattle are two alternatives to dehorning in the future and policy decisions have to take into account the need of a balance between these two options. Assuming that high genetic polled bulls will be available in coming years, it is then advised to monitor the consequences, in particular in term of possible detrimental effect on the animals themselves and on the possibility for farmers to keep on rearing horned cattle. As keeping horned adult cattle is rare, it is further suggested to support farmers who, by keeping horned cattle, can suffer economic losses due to higher costs and research on the housing and management of horned cattle.

WP 2.1. State of the art of dehorning in the Member States

Work package objectives

This work package had the following objectives:

- 2.1.1. To estimate how many cattle are dehorned or not, and how dehorning is practiced across the European Union.
- 2.1.2. To analyse farmers' attitudes towards dehorning practices vs. horned animals.

Progress towards objectives

Two tasks were performed within WP2.1:

- Task 2.1.1. Quantitative survey of current dehorning practices.
- Task 2.1.2. Analysis of attitudes of farmers towards dehorning.

Task 2.1.1. Quantitative survey of current dehorning practices.

(detailed description available in Deliverable D.2.1.1)

Task 2.1.1 was developed through a large survey carried out in the Member States under the responsibility of some partners of ALCASDE Consortium. Contacts were established with local experts from relevant institutions like Universities, National farmers' associations, cattle breeders associations, farm veterinarians and practitioners. In each Member State, specific questionnaires were submitted to experts of three cattle categories: dairy, beef, and suckler herd. After data collection, a quantitative analysis has been carried out in order to produce figures on dehorning practices and on the prevalence of disbudding/dehorning for each cattle category in Europe and in four EU macro-regions (North, Centre, East and South). Data from the survey showed that in Europe, 81.5% of dairy, 35.8 of beef and 62.5% of suckler cattle are currently dehorned. Regardless of cattle category the percentage of dehorned animals is the highest in the North macro-region. The overall prevalence of polled cattle is very low, particularly in the dairy cattle population (<1%). The percentages of polled beef and polled suckler cattle are a little higher than in dairy (3.2 and 7.7%) since polled beef breeds are raised in the North and the East macro-regions. Dehorning is performed primarily in cattle housed in free stall systems in order to reduce the risk of injuries for the stockman and among the pen-mates as well as to allow an easier handling of the animals. Regardless of cattle category, when production system was considered, results for cattle reared according to a conventional production scheme were similar to those of the total population while organic cattle are less dehorned. As a method of horns removal, disbudding is generally preferred over dehorning. The latter method is performed for work safety reasons mainly when there is a change in the farm housing system (from tie to free stalls) or on horn-injured animals. Hot iron is the most used method of disbudding especially in the North and Centre macro-regions. The use of caustic paste appears more frequent in the South and the East. Dehorning of more aged cattle is mainly performed with the wire/saw method. Other instruments (guillotine, grinders and sheers) were reported only in specific Countries. Some kind of anaesthetic and/or analgesic treatment is administered to the animals prior to or after disbudding only in a small percentage of dairy (20), beef (35) and suckler herds farms (29). The use of drugs has shown to increase when dehorning is carried out on more aged animals (72% of dairy, 52% of beef and 41% of suckler herds farms), since it is a more invasive procedure. However reported treatment protocols appeared to be inconsistent across Countries.

In the large majority of European farms, the stockman is the main person in charge of calves disbudding. Horns removal from more aged cattle is performed with a frequent use of drugs and therefore it is more consistently carried out by veterinary practitioners, often with the assistance of the stockman.

Task 2.1.2. Analysis of attitudes of farmers towards dehorning.

(detailed description available in Deliverable D.2.1.2)

The Task 2.1.2 aimed at getting a better understanding of the farmers' view towards raising either horned or dehorned or polled cattle, the disbudding and dehorning methods and the alternatives.⁹⁴ farmers from 3 countries (Italy, Germany and France) participated in 9 focus groups. The sample shows a significant and interesting diversity of characteristics, and a diversity of views concerning the topic of dehorning.

To keep horns or not:

Many farmers chose to keep horns or not a long time ago: they are used and skilled to working like this, the cows got used to, they have adapted their housing and equipment accordingly. It seems to them to be the right way, and changes are difficult to face or imagine. Working with horned or hornless animals is not just a detail. Instead it results from and implies different views on the farmer profession and on the practical and daily work with the animals. In favour of dehorning or keeping polled animals, farmer safety and animal safety (fewer consequences are often mentioned together, especially in connection to loose housing in dairy and suckler cows. The local habit or norm plays also some role: “a modern cattle farm has dehorned animals”.

In favour of keeping horns, different aspects are combined: ethic considerations towards the animals (integrity of the animal, avoidance of pain and stress), a strong farmer-animal relationship, and assumed better health and product quality. Keeping cows with horns may also contain an ideological statement of resistance against rural industrialization. For farmers keeping horns with rustic cattle breeds in tied stalls (Salers in France, Rendena in Italy), tradition, aesthetic and tourism considerations are essential.

It is very important to underline that working with hornless animals is not necessarily related to a worse farmer-animal relationship. Many farmers place the animal at the centre of their work, but decide differently on the question of horns. Those that do dehorn or keep polled cattle also think that this is in the interest of the animals or even make their decision from animal welfare considerations. For the animals to be fattened, the situation towards dehorning is more variable and less discussed because of the shorter life span and the reduced safety risks.

The methods:

The farmers often dislike having to disbud or to dehorn cattle, the procedure being unpleasant both to the animals and to the farmers. Nearly all the farmers interviewed disbud. They are used to the methods they apply and are mostly satisfied with them. More farmers use hot iron than caustic paste. Only few of the participating farmers use sedation or anaesthetics and no one use analgesia. Some farmers would be interested to apply anaesthesia if they were allowed to do it themselves. Others think that there is no need, as the operation is very quick. For most of the farmers, adult dehorning has to be avoided, as it is too stress- and painful for the animals. Even those practicing adult dehorning are critical and often prepared to move to disbudding. Most farmers think that the animals suffer during disbudding, but their views on the extent differ largely. They additionally mention that the handling itself puts the animals under stress.

Prospects for the future:

The majority of the farmers would not spontaneously change their practice as they are strongly motivated in keeping either horned or dehorned cattle. There are several kind of barriers to

move from a dehorned cattle herd to a horned one : the farmers' working habits (some have been dehorning forever or for a long time), the representations shared by the farmers and by many operators (regarding loose housing and dehorning in modern herds for example), the housing facilities (space allowance per animal, equipment), the production system and the working organization (calving outdoors, or calving in groups for example), the stockman's skills to manage horned animals. These barriers are all the more effective because the topic of keeping horns and dehorning is rarely discussed. Some farmers are considering to modify their practice regarding dehorning in that they would disbud instead of adult dehorning, or disbud the animals at a lower age, and it meets what seems obvious for the majority to reduce animal pain. Many farmers are rather interested in polled cattle which also have a high quality for production and reproduction. But mostly they do not believe that it is feasible at short notice. All state that they must have the right to choose which animals they would like to work with. Training sessions and specific advice would be useful concerning either the management of a horned herd, or the good disbudding/dehorning practices (including handling, medication, etc.). The farmers are concerned but also the operators such as veterinarians, technicians, transport drivers, etc., who also have to be implied.

Deviations from the project work programme and corrective actions taken

The survey tried to gather information from all the EU Countries, however a few of them it were impossible to set up a reliable national contact and to collect trustworthy data. Results of the corresponding Macro-region were used to estimate the dehorning situation for the missing Member States.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.2.1.1	Quantitative survey of current dehorning practices	Mar 09	Sept 09	UNIPD
D.2.1.2	Analysis of attitudes of farmers towards dehorning (9 focus groups)	Jun 09	Sept 09	UNIPD

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.2.1.1	Questionnaires	Jan 09	Jan 09	UNIPD
M.2.1.2	Discussion guide	Apr 09	Apr 09	UNIPD

WP 2.2. Assessment of benefits and drawbacks of dehorning and alternatives to dehorning in dairy and beef cattle

Work package objectives

This work package had the following objectives:

2.2.1: To summarise possible effects of dehorning on the development of the animals assess and to assess the pros and cons of current alternatives to dehorning: keeping fully horned animals

2.2.2: To assess the pros and cons of current alternatives to dehorning: producing polled animals

Progress towards objectives

Two tasks were performed within WP2.2:

Task 2.2.1. Benefits and drawbacks of the rearing of horned cattle compared to dehorned cattle.

Task 2.2.2. Benefits and drawbacks of the selection and rearing of polled animals.

Two reviews of scientific and technical publications were carried out on benefits and drawbacks of cattle dehorning/disbudding and their alternatives: keeping fully horned cattle (2.2.1) or introducing polled animals (2.2.2). SP2 partners and EAAP Cattle Working Group members were given opportunity to contribute (2.2.1).

Task 2.2.1. Benefits and drawbacks of the rearing of horned cattle compared to dehorned cattle [UKA]

(detailed description available in Deliverable D.2.2.1)

Arguments for and against dehorning/disbudding relate to human safety, animal welfare, ethics, economics, cultural aspects and product quality. While dehorning has stronger negative welfare effects than disbudding, any method of disbudding/dehorning causes distress and pain, which should be alleviated as far as possible, preferably by a combination of sedation (in animals not used to handling), local anaesthesia and anti-inflammatory treatment. For keeping fully horned cattle specific housing and management recommendations are available that include a number of higher minimum recommendations than those for hornless cows. However, the identified risk areas are similarly relevant for horned and hornless cattle. There is a lack of scientific studies into the relevance of horns for cattle.

Task 2.2.2. Benefits and drawbacks of the selection and rearing of polled animals [ASG].

(detailed description available in Deliverable D.2.2.2)

The natural absence of horns is determined by a single gene, with polled (= hornless) being dominant over horned. The frequency of polled varies between breeds from 0 to 100 %. In Holstein polled animals have a low genetic merit. Classic breeding programs to increase the frequency and genetic merit of polled animals take long. Computer simulations showed that with genomic selection high genetic merit polled bulls can be bred within 10 years. Consultations showed that farmers are only interested in using polled bulls if they have a high genetic merit, and breeding companies are starting to develop breeding programs in Holstein. In Fleckvieh breeding programs are well under way.

Deviations from the project work programme and corrective actions taken

There was a slight delay in submitting deliverable 2.2.1, but otherwise there were no deviations.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.2.2.1	Report on the assessment of dehorning and the keeping of horned dairy and beef cattle	Jun 09	Oct 09	UKA
D.2.2.2	Report on the assessment of breeding strategies in relation to the introduction of the polled gene	Jun 09	Oct 09	ASG

List of milestones

Milestone No.	Milestone name	Date due	Actual date	Lead contractor
M.2.2.1	Draft report on the assessment of dehorning and the keeping of horned dairy and beef cattle ready for review among partners	May 09	Aug 09	UKA
M.2.2.2	All necessary information gathered for draft final report on the assessment of breeding strategies in relation to the introduction of the polled gene	May 09	Sept 09	ASG

WP 2.3. Short term and long term strategies for future development

Work package objectives

This work package had the following objectives:

- 2.3.1. To find solutions to overcome actual problems or limits to alternatives to dehorning.
- 2.3.2. To check acceptability of alternatives to dehorning by stakeholders.
- 2.3.3. To formulate final recommendations on alternatives to dehorning.

Progress towards objectives

Three tasks were performed within WP2.1:

- Task 2.3.1. Further development of alternatives to dehorning
- Task 2.3.2. Stakeholders' conference
- Task 2.3.3. Final recommendations

Task 2.3.1. Further development of alternatives to dehorning

(detailed description available in Deliverable D.2.3.1)

The objective of the task 2.3.1 was to find some viable solutions taking into consideration some alternatives that could be used in dehorning. Keeping horned cattle in loose housing could be considered at the farm level from two different points of view. From one point of view we can consider animal welfare as an important issue and in this case the measures that could be used at the farm level must be addressed on how to avoid social stress, how to be considered the housing characteristics in this case and what are the management techniques that must be putted in practice in keeping horned cattle.

The social stress could be avoided by using in practice knowledge about social behaviour in cattle breeding and about different ways in which animals interact in their social structure. The design of housing facilities must be done in an appropriate animal welfare manner on all general characteristics, but also with respect from separate facilities (areas by cattle for walking, resting, feeding, milking etc.). Other practices of farm management could be successfully used in feeding, social behaviour or human-animal relationship. Better known from some research developed in the case of dairy cows, further investigations to be done in practice for beef suckle herd, young stock or fattening bulls could be stringent in improvement some techniques that could be successfully used in different farms with different breeding purposes.

From the other point of view the human safety must be viewed through the application of some ways to reduce the risk by using appropriate handling facilities and housing systems and by improvement of human cattle relationship.

To develop and implement in parallel the two alternatives, keeping horned cattle and keeping polled cattle, would offer free choice for farmers according to their attitudes, traditions and husbandry conditions.

Task 2.3.2. Stakeholders' conference

(detailed description available in Deliverable D.2.3.2)

This project and especially Subproject 2, is aimed to contribute at the improvement of animal welfare in the EU based on researches and different studies and the development of some future strategies. To check acceptability of alternatives to dehorning by people working in this field

was organized a conference (Task 2.3.2) with the scope of getting more details about the potential barriers that could be present in using disbudding, dehorning and alternative to these methods. At this conference were presented both scientists and stakeholders from various organizations (meat, dairy and leather industries, farmers and breeders, policy makers, veterinarian organizations and NGOs) and different parties with interests in this field.

At the conference, the ALCASDE project was introduced to the stakeholders. It was agreed that in some techniques currently used in Europe there is some confusion and there is a need for consistency regarding the use of a specific technique. As a matter of fact, some unpleasant effects that seriously affect the animal welfare and the human health are faced right now. Based on scientifically results it was concluded that the use of a specific technique less harmful to the animals and not to put in danger the human health must be used at the level of European Union countries. The use of disbudding method was agreed to be an appropriate way. Specific techniques must be accompanied by the use of pain alleviation like anaesthetic and non steroidal anti-inflammatory. At the same time a method like disbudding must be done by a trained operator which must have knowledge about anatomy and physiology of horns, the use of specific equipment and also to be legally in charge when using appropriate pain releaser.

The use of dehorning in European Union countries revealed the fact that in some cases is performed by inappropriate personal and without the use of appropriate drugs. As a matter of fact it was concluded that this method must be done only in certain circumstances and only by appropriate personal. Some techniques accompanying the dehorning already in use in some countries, like the use of sedation remain an open subject for researches, farmers and veterinarians. At this conference was resume that sedation could be stressful for the animal and there is a need for further research in this field.

The use of polled gene in cattle was a very exciting subject at this conference and generated implications in this debate from the point of view of scientists, farmers, industry and NGOs. After some presentations about new findings in research of polled gene in cattle and positive results experienced in practice (see the case of Charolais and Fleckvieh breeds) it was agreed that the use of this technique could be very useful. The conference was marked in a positive way by a discussion about keeping horned cattle in different farming systems. The decision of farmers on keeping horned cattle must not to be affected by different actors from the chain. These farmers could be aware about the risk that are facing and this could be a result of handling practice in some cases. At the same time they should be involve in improved animal welfare techniques by the using of appropriate housing and handling facilities and appropriate management techniques.

At the same time further research in this area could represent some realistic support for farmers. The realization of some materials like courses, good practices guides, information platforms etc. could contribute at the success of these alternatives.

The ethics in animal welfare was the last topic discussed at the end of this conference. All actions that could affect the animal welfare of cattle could be analyzed from an ethical point of view. Ethical considerations and attitudes of consumers also play a role when implementing alternatives to dehorning with regard to acceptability of products and farming practices in general or for product labelling.

Task 2.3.3. Final recommendations

(detailed description available in Deliverable D.2.3.3)

Based on the findings revealed by the Subproject 2, a final report was elaborated (Task 2.3.3) that contained recommendation and an actions plan with respect to alternative on dehorning. These recommendations were elaborated on both short and long term strategies.

On short term strategies the improvements in disbudding practices must represent an opportunity for European Union countries. On the one hand, the use of an appropriate Good Practices guide and training about dehorning in European countries will contribute to the use of appropriate techniques in an adequate manner; facts that could successfully improve the animal welfare and human safety. On the other hand the use of appropriate pain releaser by a trained operator could reduce the stress of animals being subjects of disbudding.

In long term strategies the use of polled gene in cattle must be considered as an alternative to dehorning but the future of polled cattle is difficult to predict.

As dehorning in loose housing system is largely predominant, few recommendation and information are available for farmers who want to keep horned cattle and further research is needed in order to provide valuable advice. Keeping horned cattle could induce economic losses in relation with higher investment costs and farmers need in some case additional support.

However, as there is a risk that the development of polled cattle induces the lack of horned available cattle, it is underlined that the policy choice must maintain a balance between the two alternatives and the freedom of choice for farmers.

Deviations from the project work programme and corrective actions taken

There were not any deviations from the regular project work programme.

List of deliverables

Del. no.	Deliverable name	Date due	Actual date	Lead contractor
D.2.3.1	Report on practical recommendations at farm level for keeping horned cattle and on the use of genetic solutions.	Sept 09	Oct 09	VUW
D.2.3.2	Proceedings of stakeholder conference.	Oct 09	Nov 09	IRTA
D.2.3.3	Final recommendations to DG-SANCO regarding alternatives to dehorning.	Nov 09	Nov 09	IE

List of milestones

N/A

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APPENDIXES (DELIVERABLES)

Module A: Management

Appendix	Deliverable and Title
Module A	A.A1. Minutes of the meetings organized by the Module A.

Module B: Dissemination

Appendix	Deliverable and Title
Appendix 1	D.B.1. Formation of a stakeholder group comprised of the representatives of the end users of project outputs to advise on application of methods.
Appendix 2	D.B.2. Project website set up.
Appendix 3	D.B.3. Interactive e-learning materials on website.
Appendix 4	D.B.4. International stakeholder workshop.

Subproject 1: Alternatives to pig castration

Appendix	Deliverable and Title
Appendix 5	D.1.1.1. A report on the incidence of boar taint in commercial farms in France and Spain and on observed differences in androstenone and skatole levels between breeds and husbandry practices.
Appendix 6	D.1.1.2. A report on the experimental approach of the effect of husbandry and management conditions on aggression and mounting behaviour and on boar taint levels.
Appendix 7	D.1.1.3. A report describing breed-specific expression of key skatole and androstenone metabolising enzymes and their relation to skatole and androstenone levels in adipose tissue.
Appendix 8	D.1.1.4. A report on the meta-analysis of available results regarding meat quality of entire and immunocastrated male pigs.
Appendix 9	D.1.2.1. Technical description of skatole and androstenone sensor prototypes.
Appendix 10	D.1.2.2. Report on on-line methods for skatole and androstenone detection.
Appendix 11	D.1.2.3. Programme for future research on on-line methods and commercialisation of available and newly-developed skatole and androstenone sensors.
Appendix 12	D.1.2.4. Recommendations for harmonised analysis of skatole, indole and androstenone.
Appendix 13	D.1.2.5. Programme for research on harmonisation of boar taint detection methodology.
Appendix 14	D.1.2.6. Report of the International industry-orientated workshop on on-line detection methodologies..
Appendix 15	D.1.3.1 & D.1.3.2 Report of harmonized protocol for sensorial analysis (D.1.3.1) and Pre and post phase questionnaires for consumer tests (D.1.3.2.).

Appendix	Deliverable and Title
Appendix 16 –	D.1.3.3. Preliminary test report on attitudes in Europe.
Appendix 17 –	D.1.3.4. Final Report on attitudes and acceptability with identification of potential differences among Consumers/country and region.
Appendix 18 –	D.1.4.1. An economic pork supply chain model for the production of entire males.
Appendix 19 –	D.1.4.2. A report on the economics of pig meat production from entire males in different scenarios.

Subproject 2: Alternatives to cattle dehorning

Appendix	Deliverable and Title
Appendix 20 –	D.2.1.1. Report on dehorning practices across EU member states.
Appendix 21 –	D.2.1.2. Report on farmers' attitude towards the practice of dehorning.
Appendix 22 –	D.2.2.1. Report on the assessment of dehorning and the keeping of horned dairy and beef cattle.
Appendix 23 –	D.2.2.2. Report on the assessment of breeding strategies in relation to the introduction of the polled gene.
Appendix 24 –	D.2.3.1. Report on practical recommendations at farm level for keeping horned cattle and on the use of genetic solutions.
Appendix 25 –	D.2.3.2. Proceedings of stakeholder conference.
Appendix 26 –	D.2.3.3. Final recommendations to DG-SANCO regarding alternatives to dehorning

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