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# INNOVATIVE APPROACHES IN PORK PRODUCTION WITH ENTIRE MALES AND IMMUNOCASTRATES: COST ACTION IPEMA

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**Abstract – The aim of the Cost Action IPEMA “Innovative Approaches in pork production with entire males and immunocastrates” is to facilitate knowledge exchanges within science and with stakeholders to find general, region-specific or chain-specific solutions to facilitate the development of alternatives to surgical castration: entire male production and immunocastration. For this, IPEMA creates networks between European countries and will organize several activities such as workshops, annual conferences, short-term scientific missions or training schools to coordinate research, increase efficiency and fill in knowledge gaps. IPEMA is structured in 6 workgroups (WG): breeding and genetics (WG1), nutrition (WG2), management, housing and welfare (WG3), grading and quality control (WG4), innovation and processing (WG5) and consumer and market behavior (WG6). Interactions between groups are encouraged. Furthermore, five transversal teams have been defined to organize: communication and dissemination, training and education, inclusiveness of less advanced countries, “think tank” of early career investigators and short term scientific missions.**

**Key Words – boar taint, castration, welfare**

**I. INTRODUCTION**

In 2010 representatives of different players of the European pig sector prepared the Declaration of Brussels on voluntary ban of surgical castration of male pigs in Europe by 1 January 2018. There are, however, still some unresolved issues regarding nutrition, animal management and welfare and carcass and meat quality that need to be adjusted to this new situation. The alternatives that can currently be envisaged are the production of entire males (EM) and immunocastration (IC). They introduce new challenges regarding breeding, genetics and feeding strategies to reduce boar taint, animal welfare, product quality and consumer demands and attitudes. Additionally, there are knowledge gaps in EM and IC production between Eastern and Western European countries. For these reasons, a Cost Action entitled ‘Innovative approaches in pork production with entire males (IPEMA)’ was prepared and will run from October 2016 to October 2020.

The main reason to abandon castration is animal welfare. Nevertheless, rearing EM may also introduce welfare problems due to their increased aggressive and mounting behavior. Furthermore,

one of the main risks of rearing EM is the production of tainted carcasses. Boar taint is mainly due to two compounds, androstenone (AND) and skatole (SKA), which concentration is affected mainly by genetic, feeding, management and slaughter weight. Because tainted meat is rejected by consumers, the presence of tainted carcasses may prevent the ban of castration or, when EM are produced, this may impose price reductions for the farmers due e.g. slaughtering at lower body weight. It is therefore important to address all the complex issues associated with EM production. The incidence of boar taint may be reduced via feeding, animal management or selection of boar taint-free lines avoiding side effects on other traits. The nutritional requirements for EM and IC are different and it is important to find the best strategy to obtain maximum efficiency without compromising pork quality. Also, if EM are slaughtered, tainted carcasses should be detected rapidly, if possible on-line, and meat processing industry should investigate the best way to use tainted carcasses. The greater leanness of EM compared to surgical castrates results in additional challenges regarding the technological and sensory quality of meat. Finally, consumers' and market acceptance of products from EM and IC and consumers' attitudes towards the animal welfare issues specific to these animals need to be known in Eastern and Western European countries.

Thus, the objective of the IPEMA Cost Action is to collect and generate knowledge and to promote innovations and integrated solutions for the development and dissemination of best practices regarding EM and IC production in terms of animal welfare, breeding, nutrition, management, pig carcass grading, optimization of products according to their characteristics and assessment of consumer demand and attitudes toward meat from EM and IC. IPEMA aims to develop networks of senior and young researchers and stakeholders of Eastern and Western Europe, to enhance cooperation, knowledge transfer and to support the meat industry to produce high quality pork in line with region-specific consumer demands.

## II. MATERIALS AND METHODS

IPEMA Cost Action is divided into six work packages plus five supporting teams (Figure 1).

**WP1: Breeding and genetics:** The reduction of AND and SKA through genetics is being studied. The capacity of animals to catabolize SKA is under genetic control whereas the production of SKA in the hindgut is mainly determined by nutritional and environmental factors. Genetics, alongside with dietary manipulation and management plays an important role in deposition of boar taint compounds. Non-specific selection can result in undesirable side-effects on pig performance and other traits.

IPEMA will foster collaboration between geneticists and scientists from other disciplines as well as the meat sector to find innovative genetic approaches for the creation of pig lines suitable for EM production, i.e. free of boar taint, with acceptable meat quality and corrected for unwanted aggressive and mounting behavior.

**WP2: Nutrition:** Nutrition has important effects on SKA production in the hindgut but it might also influence AND levels. Due to differences in nutritional requirements of pigs depending on sex and castration, it is critical to fine tune nutrient supply to the specific nutritional requirements of each type of animals at all development stages. The marked changes occurring in animal growth and metabolism at the time of effective immunocastration have to be investigated in depth for a better understanding of their effect on the final technological and sensory quality of pork.

IPEMA will bring together research from different institutes and industrial partners to find a way to meet specific nutritional requirements of EM and IC, and to reduce boar taint and correct deviations of other meat quality traits in EM.

**WP3: Management and housing conditions for improved animal welfare:** EM show more aggressive and mounting behavior and are more active than castrated males and this can potentially create animal welfare problems. This behavior can be modified by management strategies that allow a reduction of injuries and other problems.

IPEMA will allow the interaction between several research centers and actors of the pig production

chain to establish the best management practices to ensure good welfare for EM and IC pigs.

**WP4: Grading and meat quality control systems:** Nowadays most of the grading performed at slaughter plant considers only the carcass lean meat content. However, it is of interest to include meat quality parameters and also, in case of EM and IC production, evaluate boar taint presence in the carcasses. This grading would allow a better allocation of carcasses to specific products according to their characteristics and would therefore contribute to optimization of the process. There are currently several technologies to determine meat quality but most of them are not yet suitable for on line use, too slow or destructive.

IPEMA will encourage the exploration of new grading and meat quality control systems and establish a multidisciplinary network to identify requirements for meat quality grading and boar taint detection on line and to describe, and if possible to evaluate, the technologies that are available for this purpose.

**WP5: Processing industry and product development:** Pork from EM can have boar taint and/or a low technological and sensory quality. Processing may reduce the perception of boar taint via such strategies as dilution with untainted meat, smoking, cooking, addition of species, etc. Boar taint is also less perceived in products that are consumed cold than in cooked fresh pork or products which are consumed warm. The lower intramuscular fat content in EM meat can decrease tenderness and juiciness. There are also indications on inferior water holding capacity of EM meat. Regarding IC meat, at present there is no information on potential drawbacks.

IPEMA will bring together researchers and meat industry to facilitate the discussion of processing alternatives for EM meat to ensure a good technological and sensory quality and to mask boar taint in order to increase the value of this type of meat.

**WP6: Evaluation of consumer behavior and development of specific information strategies:** Several thresholds of AND and SKA content have been suggested. However, a clear definition of boar taint is still lacking, especially as studies are difficult to compare due to large methodological

differences. Therefore, harmonization of these protocols is required. Only a few studies have investigated the attitudes of consumers towards EM and IC production and products in some Western European countries; more research is needed to better understand to which extent the attitudes and expectations differ between various areas of Europe.

IPEMA will bring together researchers and industrials from across Europe to investigate geographical and cultural differences in the preferences of consumers and market acceptance for EM and IC products.

**Short Term Scientific Missions:** Short term scientific missions (STSM) are COST tools to support individual mobility in order to strengthen existing networks between home and host institutions and to create new ones. STSM allow to learn new methodologies and techniques and to work with instruments not available in the home institution.

**Training and education:** Training schools have IPEMA objectives as their main focus and may also cover appropriate re-training as part of life-long learning. Training schools can be organized as online or face to face education where students and professionals can learn techniques, methodologies and know-how related to the IPEMA objectives.

**Inclusiveness:** COST aims to incorporate target inclusiveness countries to develop a large Pan-European network that will help countries where research is at an earlier stage to improve their knowledge and competence and “board the train” of innovations related to the topics addressed in IPEMA.

**“Think tank” of Early Career Investigators:** Early career investigators (ECI) are the future and it is important to involve them in IPEMA. A “Think tank” has been created with ECI in order to allow creativeness, networking and inspiring new approaches of issues related with IPEMA that can help in the achievement of the objectives.

**Communication & Dissemination:** The achievements of IPEMA will be useless unless they are properly disseminated to a large public,

targeting all possible users of the existing and newly acquired knowledge, scientists, chain actors and other relevant stakeholders. A dissemination team has been set up that will be responsible for this task, starting with a website and the initiation of exchanges via the social media.

### III. RESULTS AND DISCUSSION

The expected results include:

1. Establishment and expansion of the network.
2. Organizing workshops, training schools, STSMs, annual meetings and conferences.
3. Strengthening and extending existing networks to form a high quality consortium to apply for future research funding.
4. Listing knowledge gaps for further research activities and develop proposals to address these gaps in coordinated approaches avoiding duplication of efforts between national programs.
  - a. Review of existing data on frequency of welfare problems within countries (WG3)
  - b. Recommendations regarding nutritional and rearing conditions aiming to reduce SKA and AND (WG2) or allowing animals to fully express their genetic potential so that this potential can be evaluated precisely (WG1)
  - c. Recommendations for improved production systems with reduced animal welfare issues (WG3)
  - d. Developed and published list of feed ingredients with boar taint reducing capacities (WG2)

- e. Handbook “Early warning system” to address EM welfare problems on farms (WG3)
- f. Concepts for international labeling of pork from high welfare production systems (WG3)
- g. Report on possible genetic parameters for behavioral traits for genetic selection (WG1)
- h. Updated nutrient recommendations for EM and IC (WG2)
- i. Review report on meat quality grading systems and their potential for on-line use (WG4)
- j. Recommendations regarding the use of meat from EM, IC for different products (WG5)
- k. Agreed protocol for evaluation of consumers and market attitudes towards EM and IC in at least 5 Western and 5 Eastern European countries (WG6)
- l. Guided communication with NGOs and consumers about improved animal welfare EM production systems (WG3)

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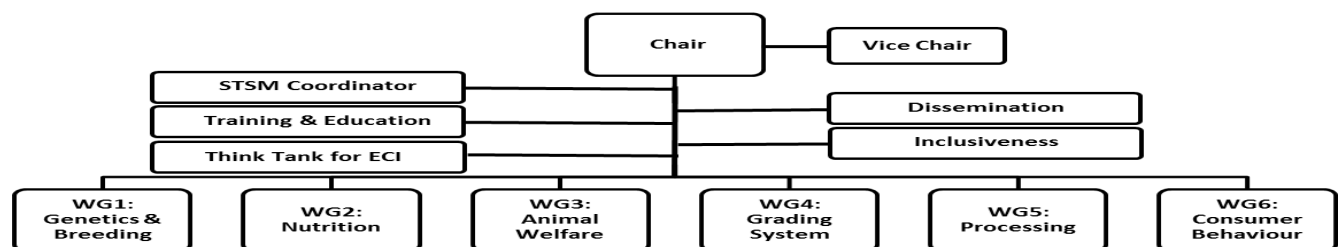


Figure 1. GANTT Diagram of the Cost Action IPEMA (STSM: Short Term Scientific Missions; ECI: Early Career Investigators)