Development of long-term, pre-finishing immunocastration protocols for male Iberian pigs.

2: Carcass

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Francisco I. Hernández García

TREASURE
Diversity of local pig breeds and production systems for high quality traditional products and sustainable pork chains

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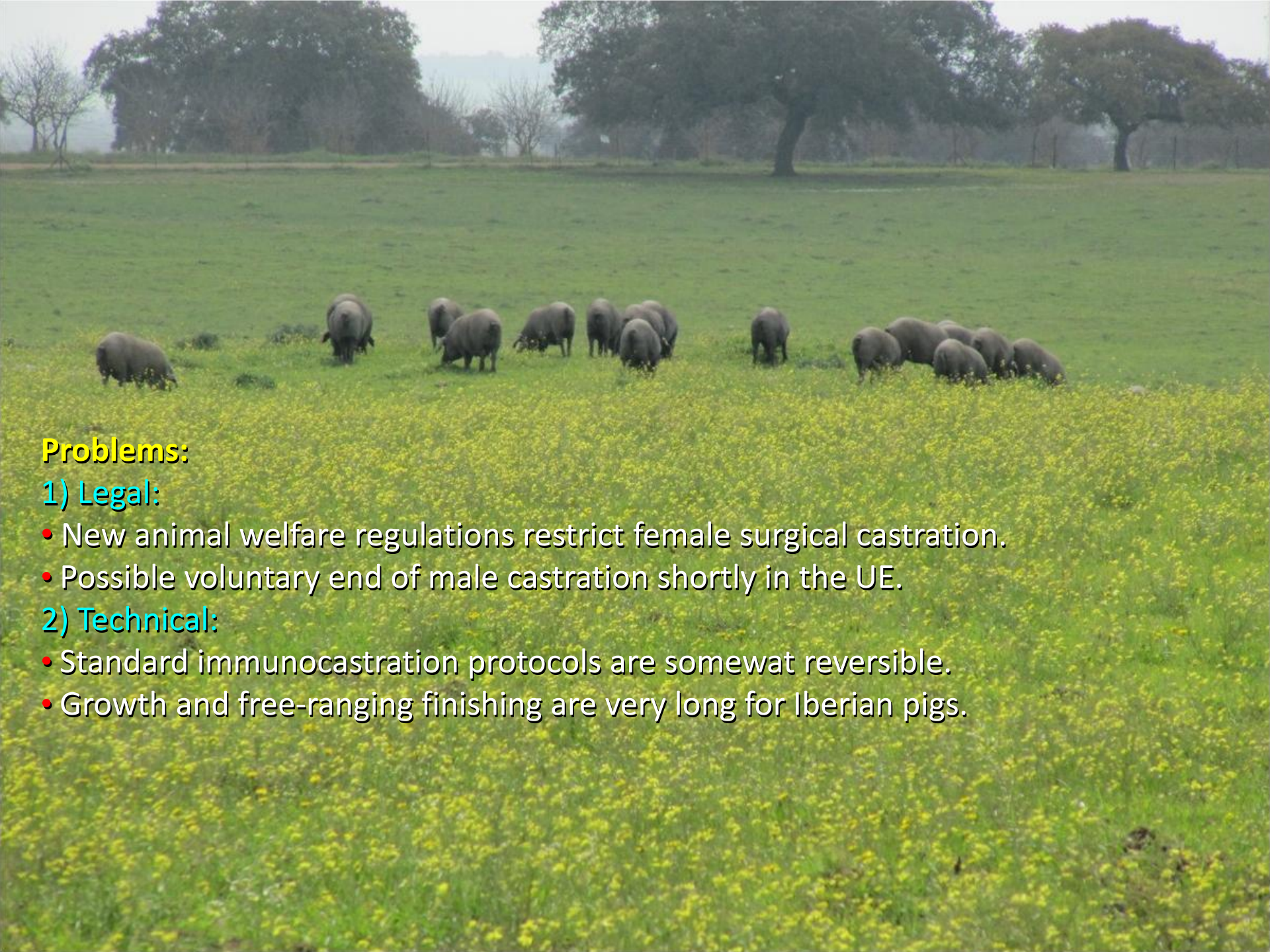
CICYTEX
CENTRO DE INVESTIGACIONES CIENTÍFICAS Y TECNOLÓGICAS DE EXTREMADURA

INIA
Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria

INTRODUCTION

Reasons for surgical castration of Iberian pigs: (males & females)

- To avoid boar taint in meat of males.
- To facilitate free-ranging management. To avoid unwanted pregnancies .
- To increase intramuscular fat deposition.



Problems:

1) Legal:

- New animal welfare regulations restrict female surgical castration.
- Possible voluntary end of male castration shortly in the UE.

2) Technical:

- Standard immunocastration protocols are somewat reversible.
- Growth and free-ranging finishing are very long for Iberian pigs.

INITIAL STUDIES

I. FEMALE PRE-PUBERTAL & PRE-FINISHING IMMUNOCASTRATION

- 3-dose protocols; slaughter at 16 months of age.
- Both protocols had a 100% efficacy.
- No unfavorable effects on meat and carcass quality
- They were directly transferred to the Iberian pig sector.

II. MALE PRE-PUBERAL & PRE-FINISHING IMMUNOCASTRATION

- Efficacy was high but variable (80% to 100% depending on the trials), with highly variable testicular atrophy degrees.
- The prepubertal protocol may revert in some individuals.
- Efficacy appeared to be affected by different factors like nutritional level and stress (origin of next study, "**STUDY 1**")

STUDY 1: Effect of feeding management on the efficacy of long- term male immunocastration protocols specifically designed for Iberian pigs

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METHODOLOGY

STUDY 1

System:

- Pigs were raised in a conventional, concentrate-based extensive system.

Immunocastration protocols:

- Late-immunocastrated males (**L-ICM** group; n=47) were immunized against GnRH at 11, 12 and 14 months of age.
- Early-immunocastrated males (**E-ICM** group; n=39) were immunized at 4.5, 5.5 and 9 months of age.
- Entire males (**EM**; n=5) were used as general controls.
- All pigs were slaughtered at 16 months of age.

Feeding management intervention:

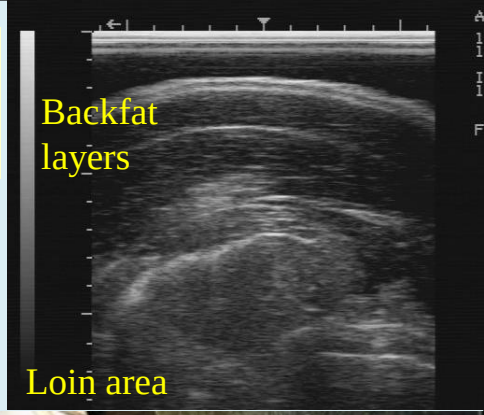
- Approximately half of each IC group were submitted to a 15-day *ad libitum* feeding period starting at the 3rd vaccination (Treated subgroups; **trt**; 23 L-ICM and 19 E-ICM), during which hopper-type feeders (*) were set in large corrals to minimize competition and stress. The remaining IC males belonged to Control (**ctrl**) subgroups.

Data collection: ***1) In vivo*:**

- Body weight (monthly) and hip height (twice).
- Body composition echography (≥ 2 times).
- Testicular echography *(in IPEMA session)(Efficacy)*
- Blood sampling *(in IPEMA session)*

Body composition echography

3.5 MHz, 12cm longitudinal probe



Weighing & echography crate

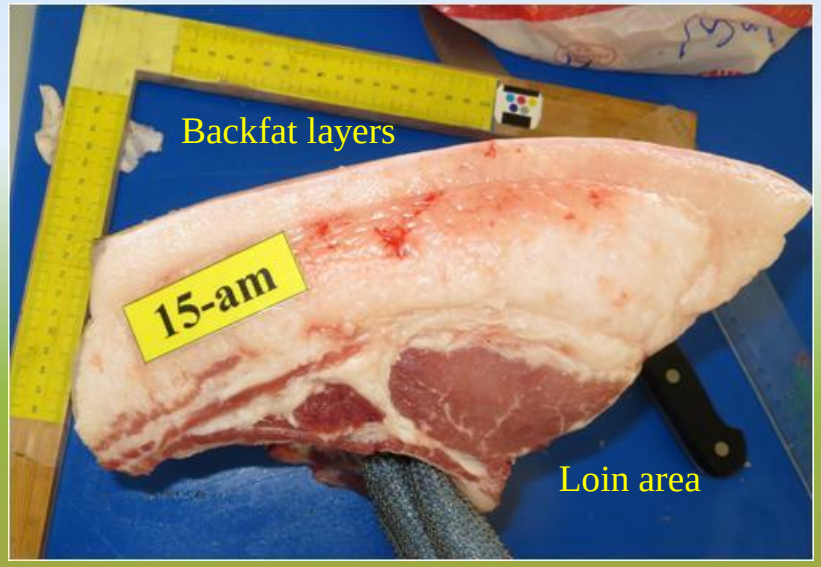
Blood sampling

Data collection: ***2) Postmortem:***

- Carcass and meat quality: Weights and measurements, intramuscular fat, fatty acid profile.
- Fat sampling for androstenone & skatole analyses. (Data not yet available)
- Tomography of hams and consumer acceptance studies (IRTA collaboration).

In IPEMA session:

- Transcriptome analyses (INIA collaboration).
- Morphometry of reproductive tract.
- Colorimetry of testicular parenchyma.
- Testicular sampling for histological studies.

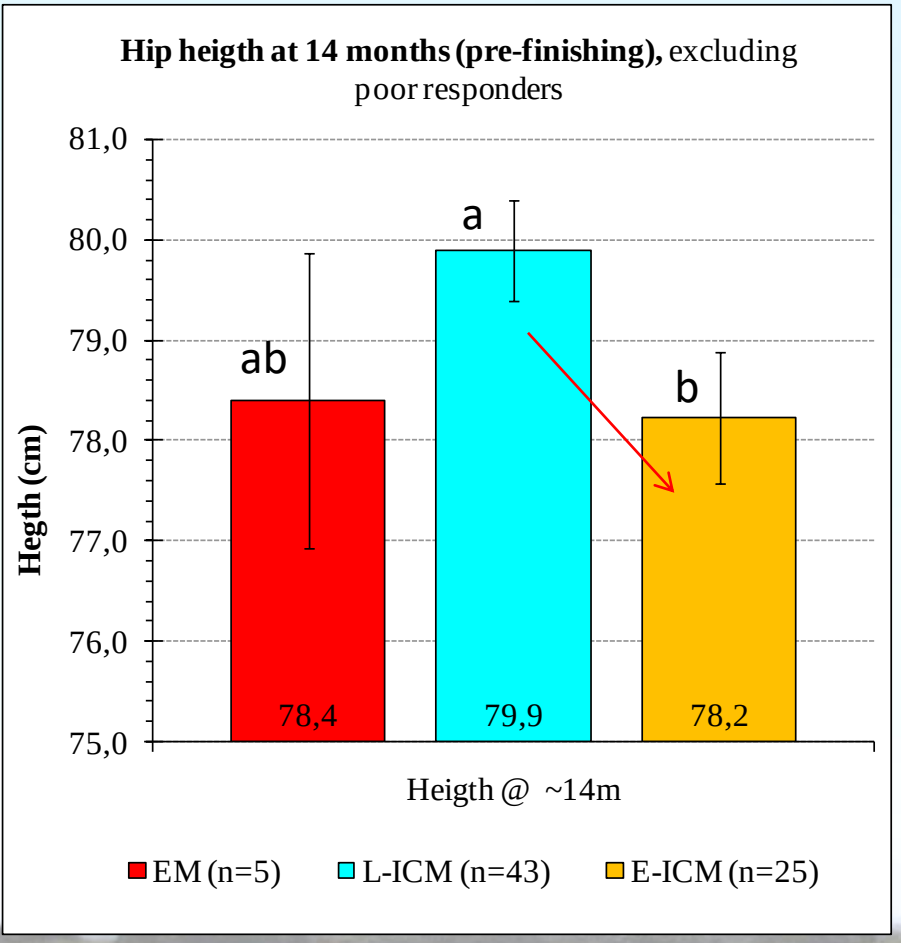


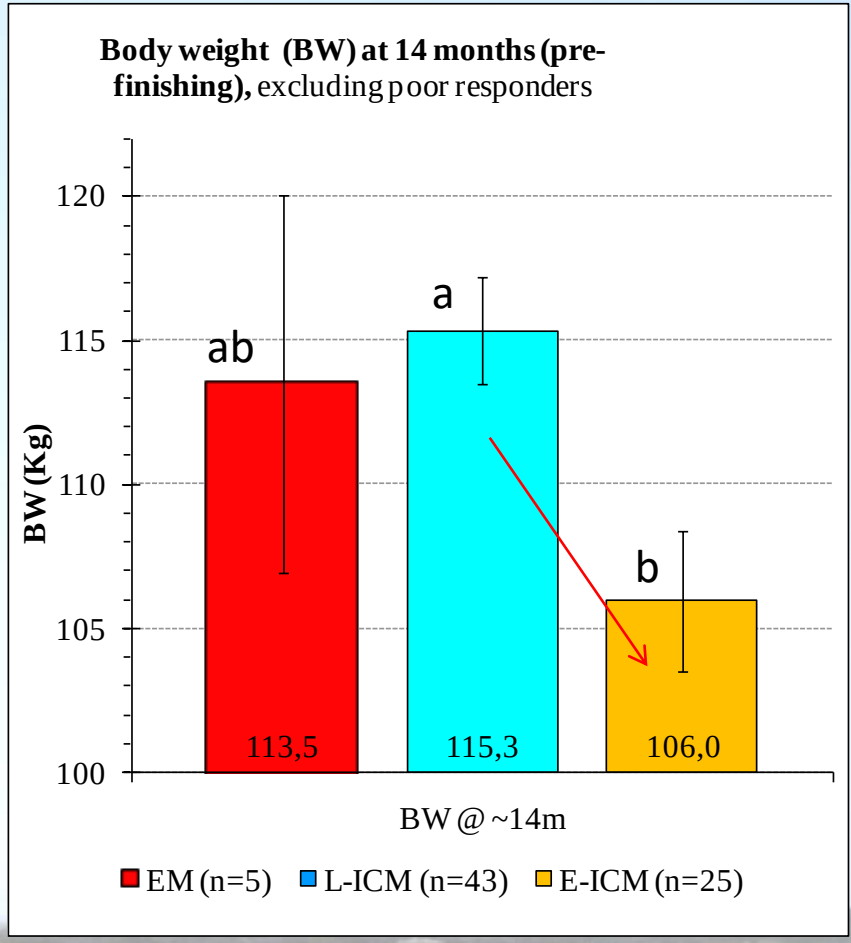
Preliminary RESULTS

STUDY 1

Body development in relation to time undergoing testosterone (anabolic) deprivation:

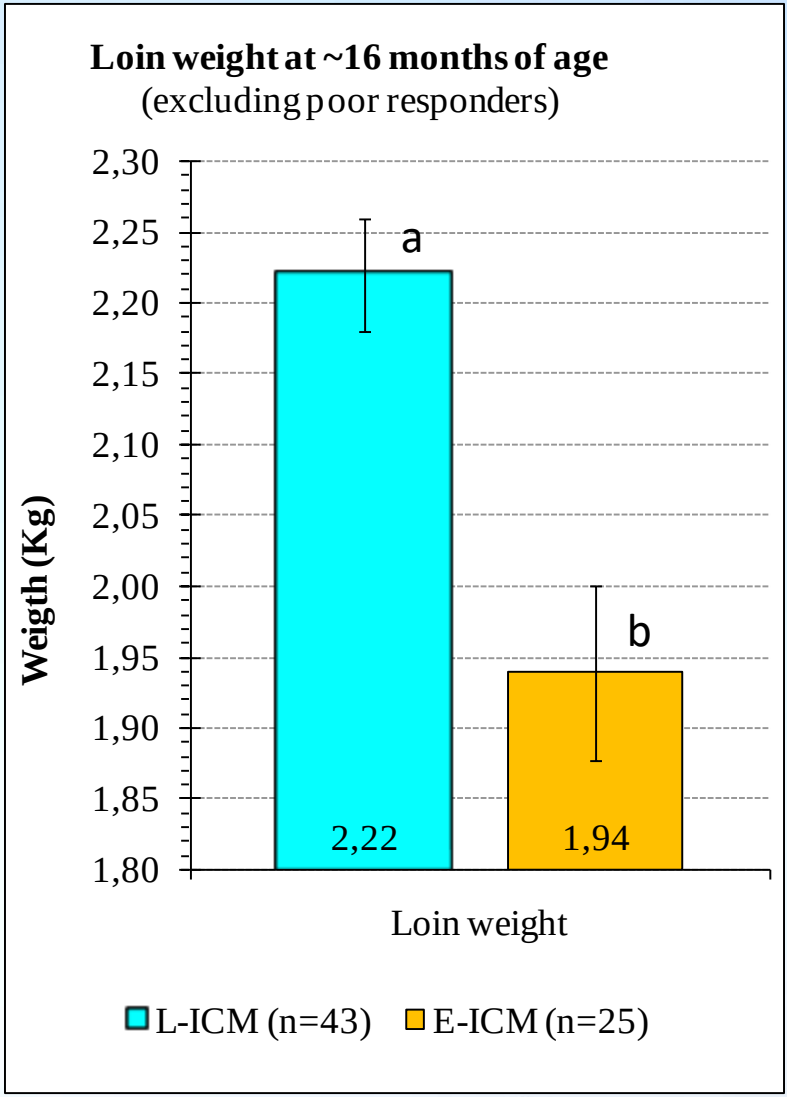
- Among the fully immunocastrated animals (<150g testes), the Late ICM were heavier than the Early ICM at 14 months of age (just before finishing).





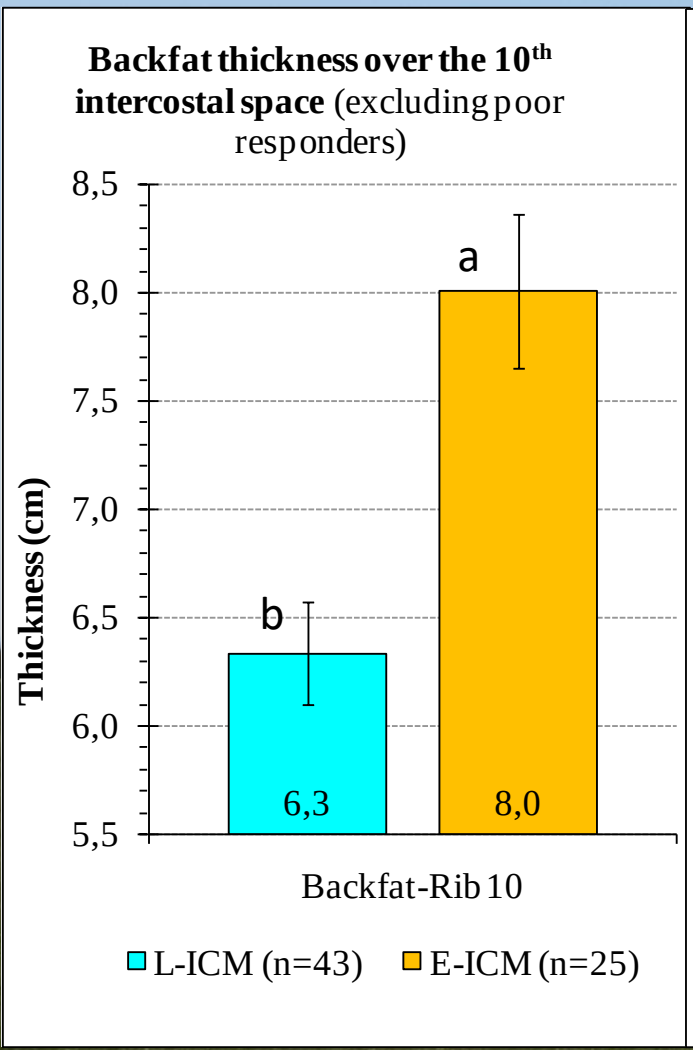
Early immunocastration facilitates management in extensive conditions, but Late immunocastration may have an advantage in growth.

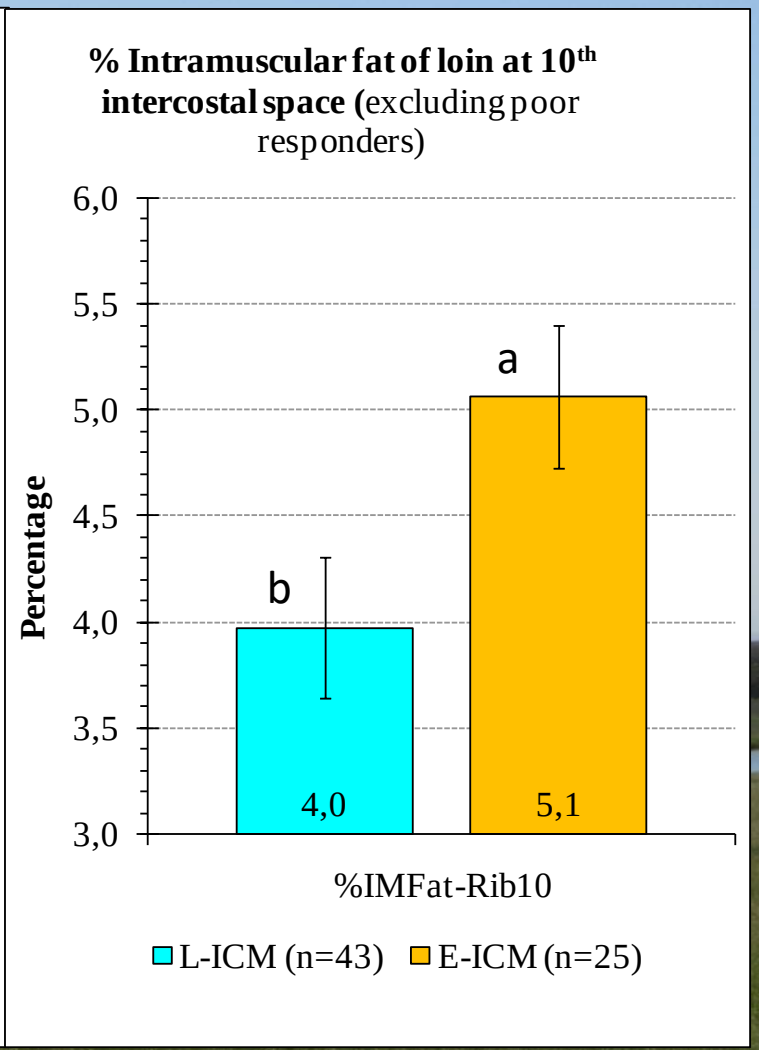
- Moreover, among full responders, Late ICM also had heavier loins than Early ICM.
  (Less time under testosterone deprivation)



- In contrast, among full responders, Early ICM had greater backfat thickness and loin intramuscular fat content than Late ICM.

  (Maybe because Late ICM only had 2 months of fattening after the last vaccination). A longer finishing post-immunocastration maybe will increase fat deposition (next study, "**STUDY 2**").





CONCLUSIONS (Study 1)

- Among Fully immunocastrated males, those under de Late IC protocol grew faster and had more muscle accretion but less fat deposition (subcutaneous and, most importantly, less intramuscular fat) than those males under the Early IC protocol.

- **Implications:** Since the Early protocol is not 100% efficient yet, new research was conducted to increase fat deposition in Late IC males through longer fattening period after immunocastration (longer testosterone deprivation time) (Study 2, within TREASURE project).

STUDY 2: Male pre-finishing immunocastration protocol: Adaptation to *montanera*

Rationale: 1) Improving body condition at the start of *montanera* will improve and homogenize testicular atrophy and also carcass composition. 2) Besides, vaccinations should finish before montanera to facilitate management and to allow more time for fat deposition.

METHODOLOGY

STUDY 2

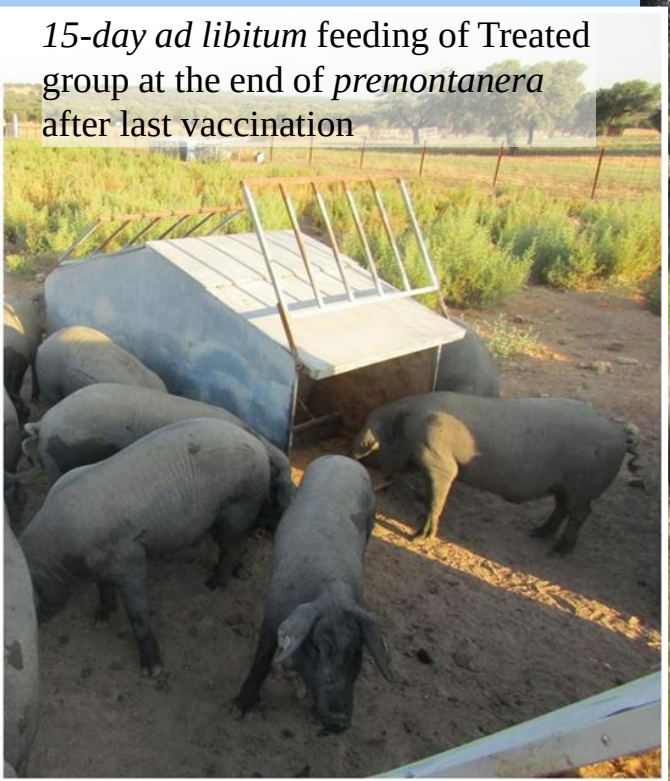
METHODOLOGY: Immunocastration protocols and management

• **Control** pigs: Vaccination (**V**) at 10.5, 12 and 13.5 months of age (V3 at *montanera* start).

• **Treated** pigs: V at 10.5, 11.5 and 13 m (V3 15 days before *montanera*). 15-day *ad libitum* feeding after V3.

• ***Montanera*** starts at 13.5 m. Slaughter at 16 m.

• **Adlib** group (Iberian x Duroc): *Ad libitum* during growth & finishing (To further study the effect of nutritional level). Vaccinations at 8, 9 and 10 m. Slaughter at 13 m (earlier, due genotype feeding system).



15-day ad libitum feeding of Treated group at the end of *premontanera* after last vaccination

Montanera feeding (longer, 3 months) up to 16 months for Ctrl & Trt groups

Data collection: (Similar to STUDY 1)

***1) In vivo*:**

- Body weight.
- Body composition echography.

In IPEMA session:

- Testicular echography.
- Blood sampling: testosterone (pre-slaughter)

2) Postmortem:

- Carcass and meat quality.
- Fat sampling for androstenone & skatole analyses (within WP3 of TREASURE).

In IPEMA session:

- Morphometry of reproductive tract.
- Colorimetry of testicular parenchyma.

RESULTS

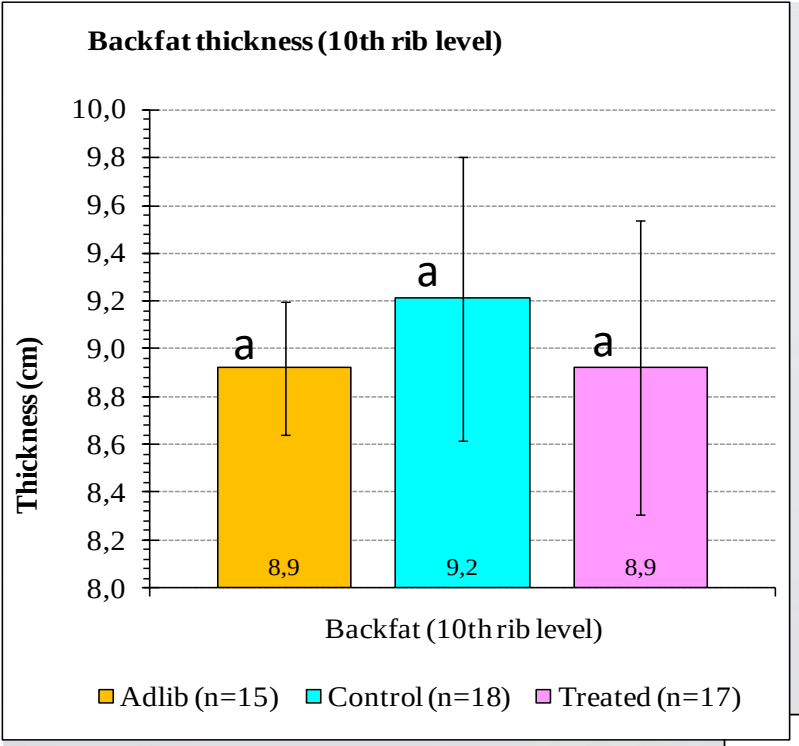
STUDY 2

- **Adlib** and **Treated** groups had small testicles (all <150g) (100% efficacy).

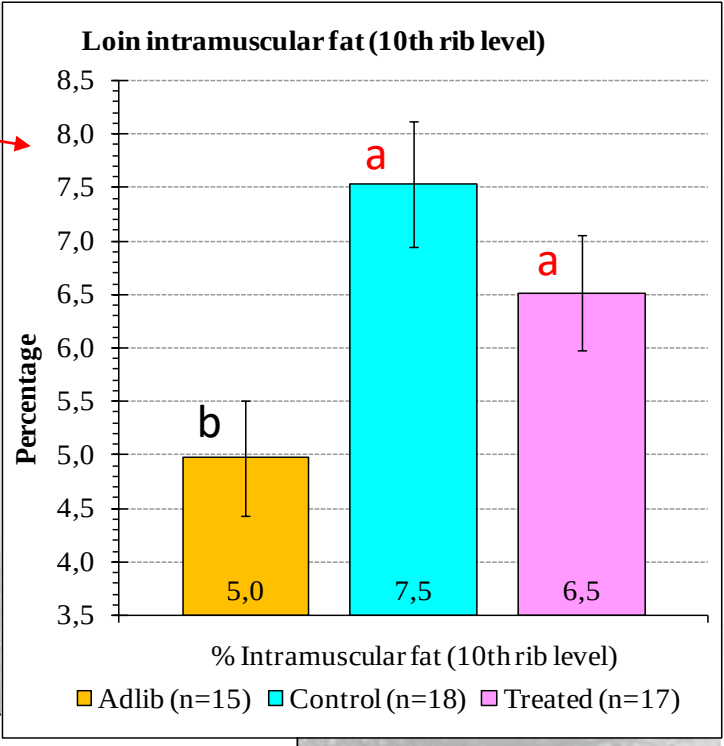
- **Control** group: 2 pigs had ~150g testicles (*)

- Fat samples (n=48) were negative for **androstenone** (<0,24 µg/g) and skatole (<0,01 µg/g).
  (But, accidentally, fat samples from the 2* Control IC males with ~150 g testes were not available).

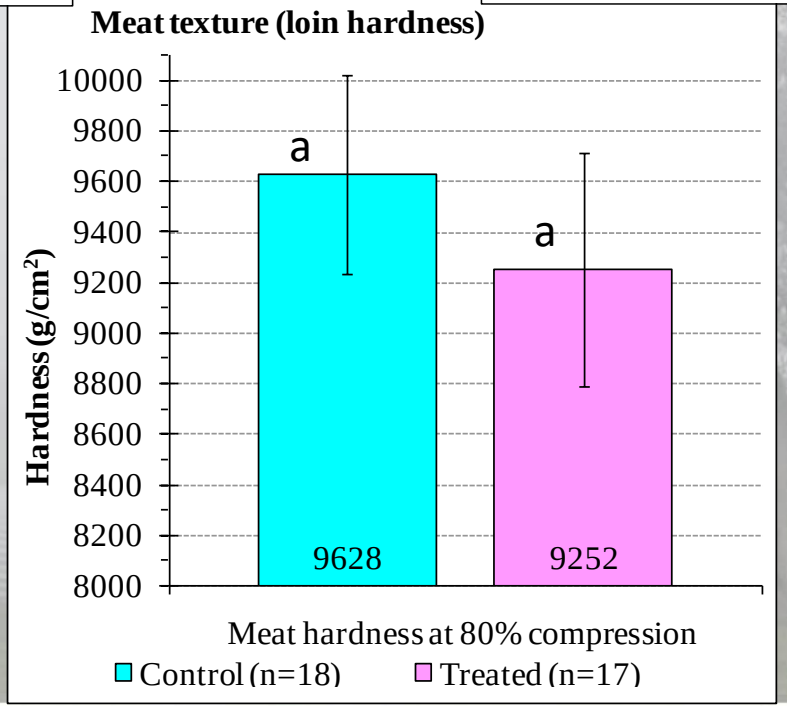
- Animals with testes below the 150 g threshold had basal blood testosterone and backfat androstenone. Fortunately, from Study 1, many backfat samples of animals with testes above this threshold are available for analysis.

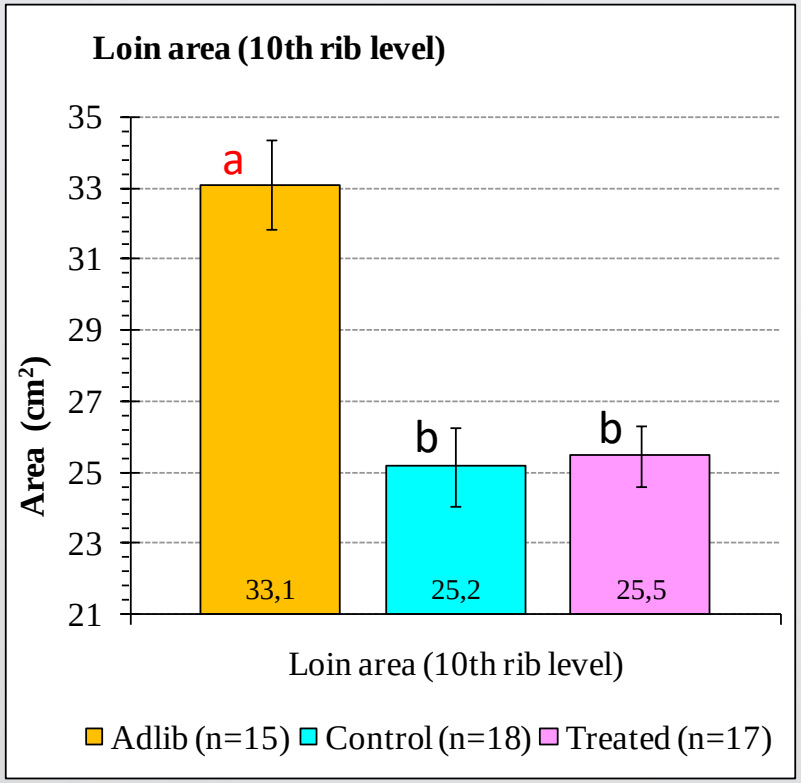


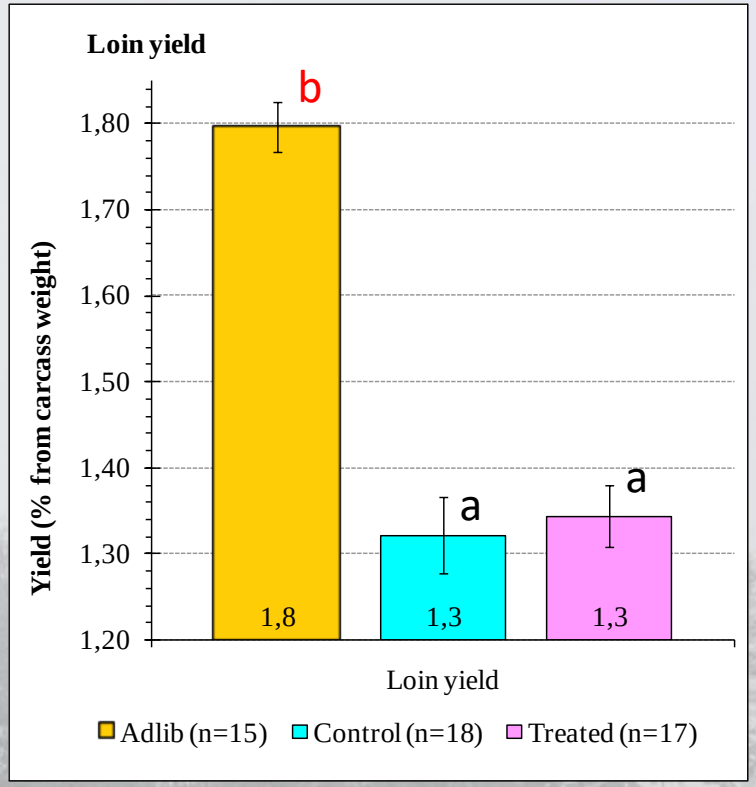
IMF and tenderness are not very different from castrates. Maybe the post-immunization period was long enough (3 months).



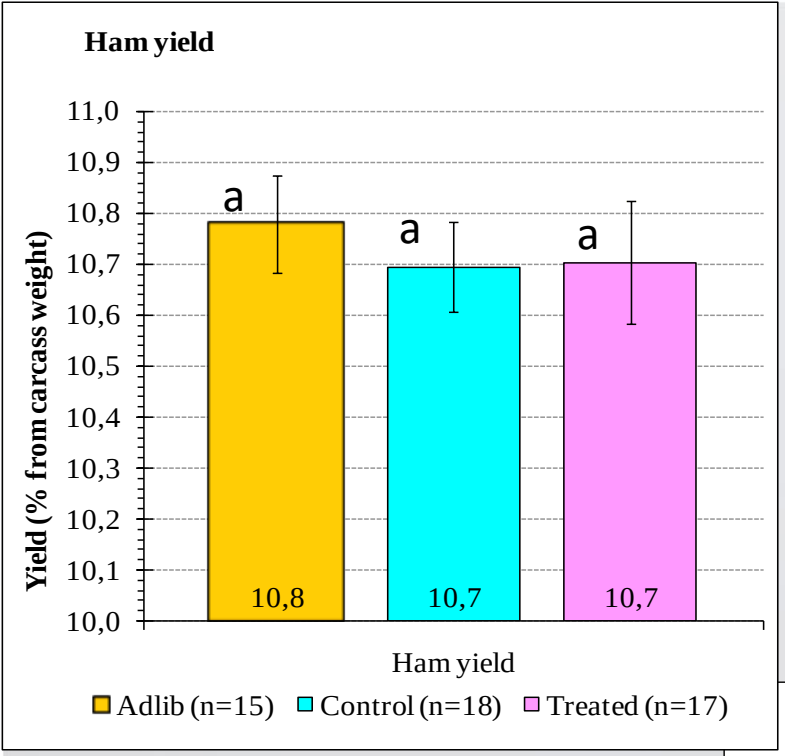
Fat cover similar for all groups

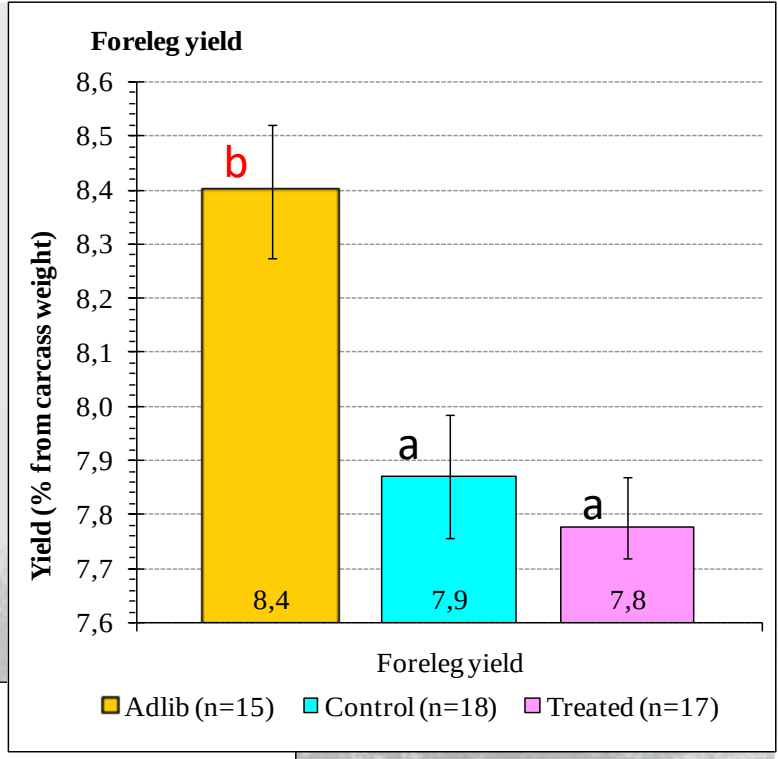




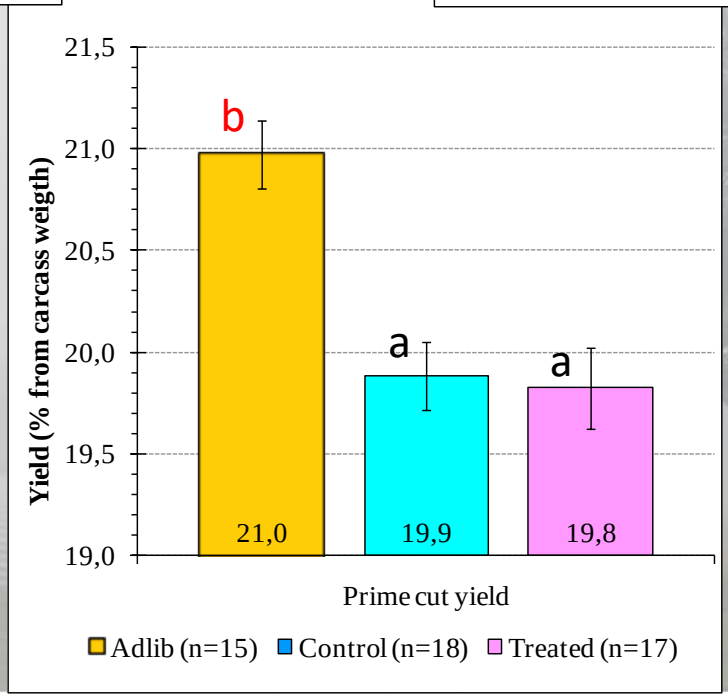


As expected, loin muscularity was greater for Adlib (Duroc x Iberian)





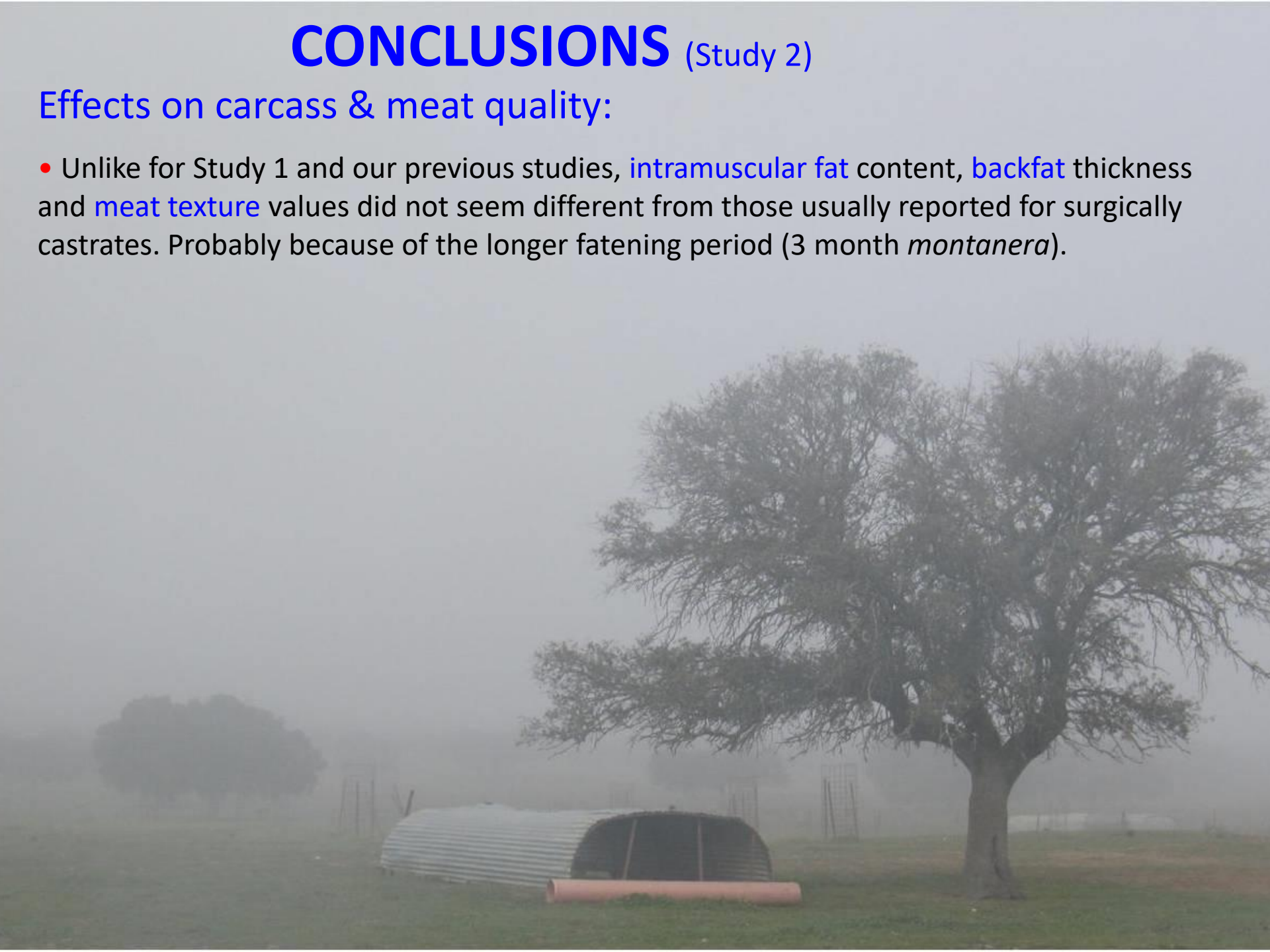
Similarly, yields based on muscularity were greater for Adlib, except for the ham yield.



CONCLUSIONS (Study 2)

Effects on carcass & meat quality:

- Unlike for Study 1 and our previous studies, intramuscular fat content, backfat thickness and meat texture values did not seem different from those usually reported for surgically castrates. Probably because of the longer fatening period (3 month *montanera*).



GENERAL CONCLUSIONS (Studies 1 & 2)

Effects on carcass & meat quality:

- From both studies, we conclude that nutritional level can be used to improve the IC efficacy, and a longer finishing after the last vaccination may increase fat deposition:

- Therefore, after a long enough montanera (3 months), intramuscular fat and meat tenderness do not appear to be worse than in surgical castrates.

Funding

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FEDER

TEAM (CICYTEX)
F.I. Hernández-García
M. Izquierdo
M.A. Pérez
A.I. Del Rosario
N. Garrido
A. Montero.

Collaboration

IRTA
RECERCA I TECNOLOGIA AGROALIMENTÀRIES

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