



Oviduct-embryo interaction in cattle: Effect of asynchrony between the embryo and the oviduct on subsequent embryo development



B. Rodríguez-Alonso^{1,2}, J.M. Sánchez², M. Hamdi¹, V. Havlicek³, U. Besenfelder³, P. Lonergan², D. Rizos¹

¹Department of Animal Reproduction, INIA, Ctra. De la Coruña KM 5.9, 28040, Madrid, Spain.

²School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4, Ireland

³Reproduction Centre Wieselburg, Department for Biomedical Sciences, University of Veterinary Medicine, Vienna, Austria

INTRODUCTION

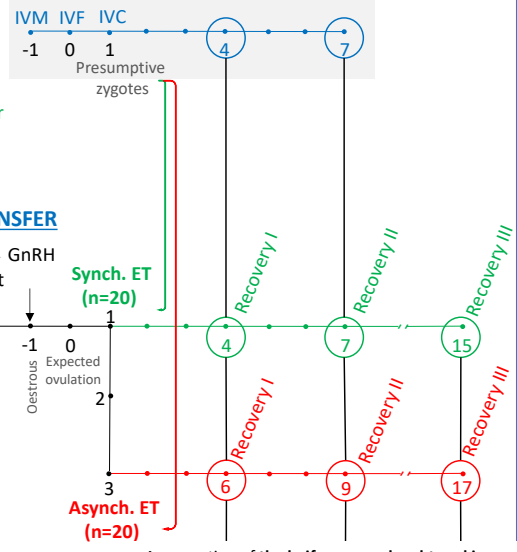
In cattle, which share a similar chronology of early embryo development with humans, while fertilisation of the oocyte successfully occurs in the majority of cases following natural mating or artificial insemination, a high incidence of embryonic loss has been reported thereafter, mostly in the first 2-3 weeks of pregnancy. Using state-of-the-art assisted reproduction techniques, **this study aimed to determine the influence of maternal-embryonic asynchrony in the oviduct on embryo development using the bovine model.** Specifically, we investigated how the oviductal environment affects early development up to the 8- to 16-cell stage (Day 4, embryonic genome activation), blastocyst stage (Day 7, cell differentiation) and Day 15 conceptus (maternal recognition of pregnancy). **Understanding how the early embryo interacts with the oviduct will improve our knowledge of the factors regulating embryo development and survival and may lead to improved in vitro culture systems.** Also, results may provide valuable information regarding the correct timing for embryo transfer.

MATERIALS AND METHODS

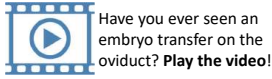
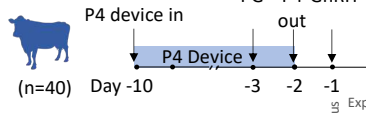
IN VITRO EMBRYO PRODUCTION

Day 1 in vitro-produced bovine zygotes (IVF=Day 0) were endoscopically transferred to the oviducts of heifers (40 cross-bred beef heifers, 50 embryos per heifer) which were either:

- Synchronous with the embryos (i.e., at Day 1 after ovulation)
- Asynchronous and ahead of the embryo (i.e., at Day 3 after ovulation)



OESTROUS SYNCHRONIZATION, EMBRYO TRANSFER AND RECOVERY

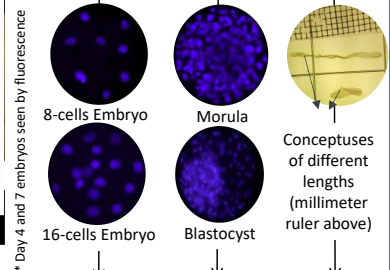


ENDOSCOPIC OVIDUCTAL EMBRYO TRANSFER

B. Rodríguez-Alonso^{1,2}, J.M. Sánchez², M. Hamdi¹, V. Havlicek³, U. Besenfelder³, P. Lonergan², D. Rizos¹

¹Department of Animal Reproduction, INIA, Ctra. De la Coruña KM 5.9, 28040, Madrid, Spain.
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A proportion of the heifers were slaughtered in a commercial abattoir 3, 6 and 14 days after transfer for embryo recovery and developmental assess at key embryo developmental stages.



SAMPLE ASSESSMENT

PARAMETER	METHOD	DAY 4 EMBRYOS	DAY 7 EMBRYOS	DAY 15 CONCEPTUSES
RECOVERY	Verification of the presence of any structure (embryos or empty zona pellucidas) under a stereomicroscope after oviductal and uterine flushing with PBS	✓	✓	✓
LOCATION	Embryo searching under the stereomicroscope from the oviduct or the uterus (flushed independently). Expected location: oviduct and uterus for Day 4 and Day 7 embryos, respectively.	✓	✓	N/A
DEGENERATION	Embryo viability status based on morphological criteria	✓	✓	N/A
DEVELOPMENT	Percentage of recovered embryos at the expected stage of development according to embryo age (8- to 16-cells for Day 4 embryos and Morula/Blastocysts for Day 7 embryos). Cell number assessed by fluorescence microscopy (embryos stained with DAPI)	✓	✓	✓
QUALITY	As an indicator of embryo quality: cell number (Day 4 and 7 embryos) and conceptus size measurement (Day 15 conceptuses)	✓	✓	✓
HEIFERS YIELDING EMBRYOS	Percentage of heifers in which at least one embryo was recovered after the flushing	✓	✓	✓

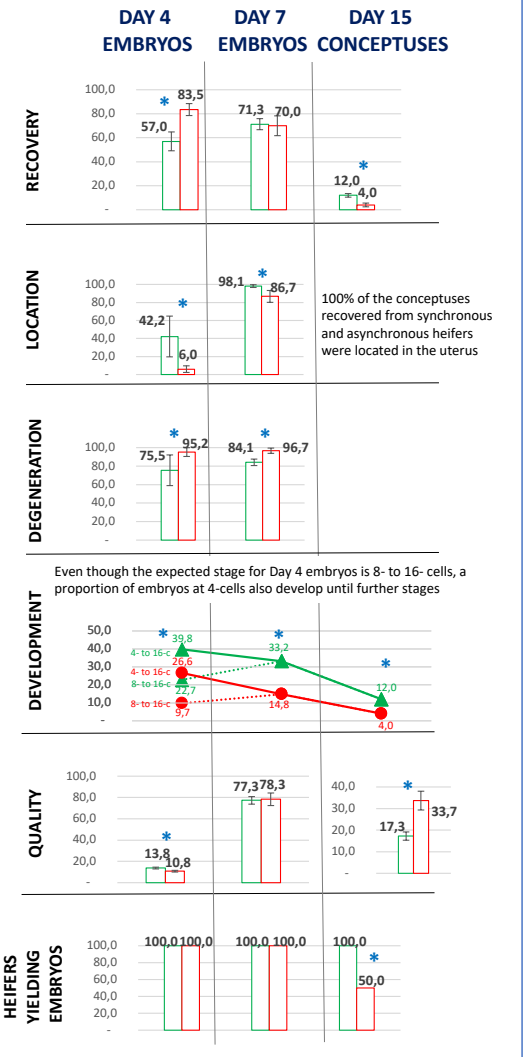
* IVM: In vitro maturation, IVF: in vitro fertilization, IVC: in vitro culture, GnRH: Gonadotropin Releasing Hormone, PRID: Progesterone-releasing intravaginal device, PG: Prostaglandin, Synch: synchronous, Asynch: asynchronous, ET: embryo transfer

CONCLUSION

Asynchrony between the oviduct and the embryo has a negative impact in terms of early embryo development leading to a lower embryo survival.

RESULTS

Data were analysed by Chi square and Student's t-test analysis. * Indicate significant differences (P<0.05)



RESULTS SUMMARY: ASYNCHRONY EFFECT ON THE EMBRYO

- | DAY 4 E | DAY 7 E | DAY 15 C |
|---------------------------------------|---------------------------------------|--|
| ↓ proportion on the expected location | ↓ proportion on the expected location | ↓ rate of conceptuses |
| ↑ % of degeneration | ↑ % of degeneration | ↑ % of degeneration |
| ↓ develop. rate | ↓ develop. rate | ↓ develop. rate |
| ↓ quality (cell num.) | = quality (cell num.) | ↑ quality (bigger conceptuses) |
| | | ↓ rate of heifers yielding conceptuses |