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The Bovine Oviduct as a Temporary *In Vivo* Culture System for Oocytes and Embryos Derived from *In Vitro* Production

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Abstract

In vitro production (IVP) of bovine embryos offers enormous potential both for agriculture and animal breeding. However, its widespread use is still fraught with problems, since *in vitro* produced embryos do not reach the quality of *in vivo* derived embryos. Thereby the aim of the present work was to explore whether a temporary culture in the bovine oviduct enhances the quantity and quality *in vitro* produced embryos. A total of 758 *in vitro* produced embryos at 8-cell stage were endoscopically transferred to the oviduct of 15 synchronised recipient heifers (43–59 per recipient) and were flushed back at day 7. As a control we produced 547 embryos parallel and cultured them until day 7 completely *in vitro* (CR1, 5% CO₂, 20% O₂). In a second experiment we incubated 646 cumulus oocyte complexes together with frozen-thawed spermatozoa and transferred both into the fallopian tube of the oviducts of 12 synchronised recipient heifers (50–77 cumulus oocyte complexes per recipient) and flushed embryos back at day 7. As a control we cultured 441 cumulus oocyte complexes which had been incubated with spermatozoa parallel to the transferred cumulus oocytes complexes completely *in vitro*. Embryos transferred into the oviduct at 8-cell stage did not reach higher blastocyst rates at day 7 than completely *in vitro* cultured embryos (23.7% vs. 24.7%). Contrary, cumulus oocyte complexes transferred together with spermatozoa into the bovine oviduct at day 0 reached significant higher blastocyst rates ($p < 0.05$) at day 7 (16.31% vs. 6.89%), day 8 (28.34% vs. 19.72%) and day 9 (31.1% vs. 24.31%) than completely *in vitro* cultured complexes. Moreover, blastocyst development (day 7/day 9) was faster in the *in vivo* cultured embryos (52.5% vs. 33.6%). Collectively, we were able to show that *in vivo* culture from fertilisation up to day 7 can enhance embryonic preimplantative development while *in vivo* culture from 8-cell to day 7 stage does not. That suggests that microenvironment in the period from fertilisation up to 8-cell stage has superior impact on bovine embryo development in terms of blastocyst quantity and quality than culture condition after 8-cell stage.

Keywords: Bovine, embryo transfer, *in vitro*, *in vivo*, oviduct