

Elevated non-esterified fatty acid concentrations during bovine oviduct epithelial cell and zygote coculture hamper early embryo development



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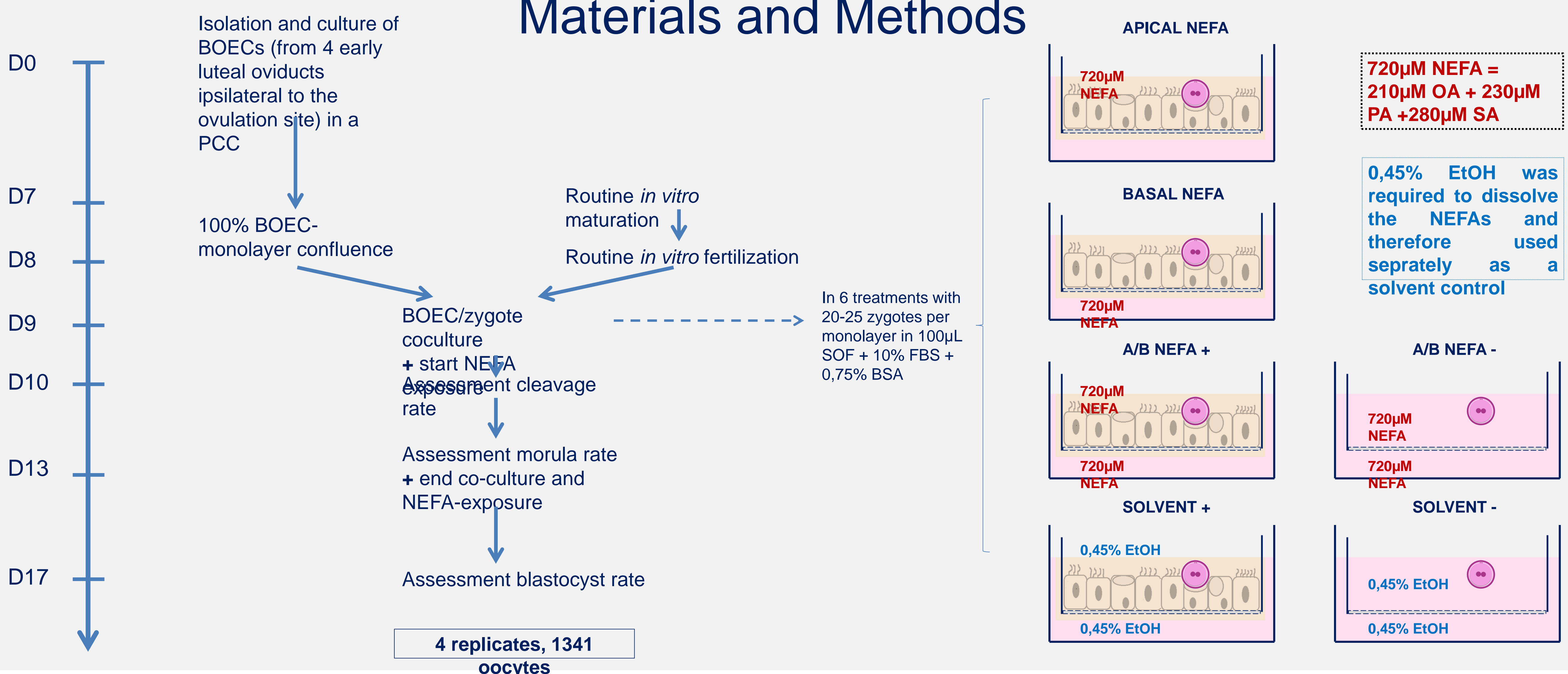
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Introduction

Maternal lipolytic disorders and the associated systemic rise of **non-esterified fatty acids (NEFAs)** have been suggested to affect oviduct physiology and functionality. And as such **altered oviduct micro-environment may influence early embryo development**, and may engage yet another fundamental part in the complexity of sub- and infertility. To unravel the individual roles of both oviduct luminal and serum NEFAs as well as the impact of NEFA-exposed **bovine oviduct epithelial cells (BOECs)** on embryo development, a **polarized cell culture (PCC) system** was used to co-culture BOECs and zygote during a 4 day NEFA-exposure period. We hypothesized that elevated NEFAs in the PCC hamper early embryo development, both directly but also through indirect effects on the oviduct. The effects may depend on the presence of bovine oviduct epithelial cells (BOECs) and the direction of NEFA exposure.

Materials and Methods



Results

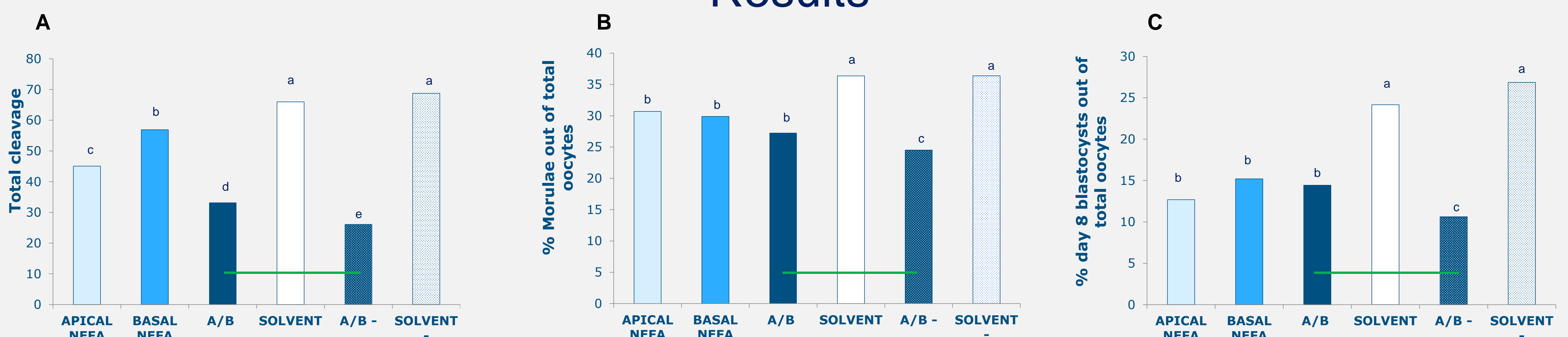


Figure 1: Total cleavage (A), morula rate (B) and day 8 blastocyst rate (C) and their significant differences between the treatment groups ($P < 0,05$). Morula and blastocyst rates were expressed as percentages out of total oocytes. The solvents did not affect any outcome parameters, regardless of the presences of BOECs. However, when bidirectionally NEFA treated, blastocyst development was significantly higher when cultured in the proximity of BOECs.

- ➔ Total cleavage in APICAL NEFA showed an increased percentage of 3-cell stage (17.61%; $P = 0.032$).
- ➔ Morula rates were similar in all treatments, but different from the solvent control.
- ➔ Day 8 blastocyst rates in SOLVENT+ and SOLVENT - were significantly higher (26.11% and 22.67%, resp.) compared to NEFA treatments (12.59%; $P < 0.001$).
- ➔ Day 8 blastocysts in APICAL NEFA were mostly young blastocysts (48.14%), while in the other treatments expanded blastocysts were most common (55.06%) with on average only 13,68% young blastocysts.

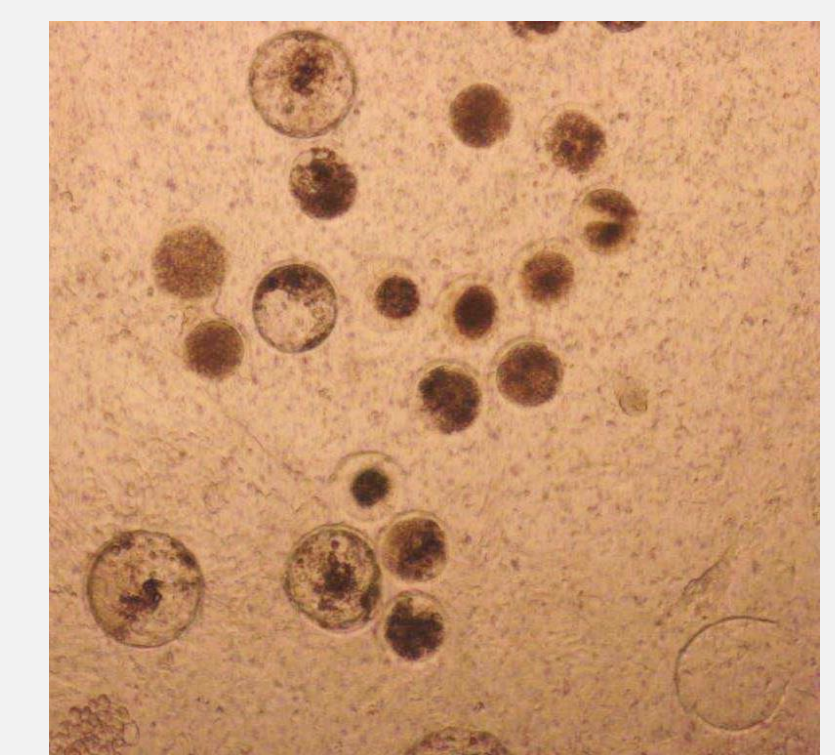


Figure 2: different day 8 embryo development stages on BOEC-monolayers

Conclusions

NEFAs negatively affect embryo developmental competence. During cleavage, but not at blastocyst level, these effects are limited to bidirectionally exposed groups, and the cocultivation with BOECs seemed to have beneficial effects on the overall outcome. Data suggest that elevated NEFAs in the oviduct may attribute to the complex pathogenesis of sub- and infertility during lipolytic disorders, however, more research is required to further elaborate on potential compensatory effects mediated by the oviduct.