

Serum albumin level of donor cows as indicator of developmental competence of oocytes

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Objectives

1. Can serum albumin level of the donor cow be used as a predictor of the developmental competence of oocytes?
2. Can in vitro embryo production (IVEP) be optimised by additional protein supplementation for oocytes derived from donor cows with inadequate (≤ 35.9 g/l) levels of serum albumin?

Materials and Methods

Oocytes were block randomised within cohorts recovered from donors with inadequate (≤ 35.9 g/l, $n = 460$) or adequate serum albumin levels (≥ 36.0 g/l, $n = 564$) to either a control IVEP protocol or a protocol with additional protein supplementation. Serum and follicular fluid chemistry was performed per cow and weighted average measures were used in pooled droplets of oocytes within the IVEP system, based on the proportional contribution towards the pool of oocytes by each cow. Correlations between metabolites in serum and follicular fluid were estimated using a Pearson correlation matrix. Multiple linear and Poisson regression models were performed to estimate the effects of different covariates on linear and count data respectively.

Results

Urea nitrogen was the metabolite with the strongest correlation between serum and follicular fluid. Although albumin in serum and follicular fluid were not significantly correlated, serum albumin was an independent predictor of follicular fluid albumin when adjusted for a dilution factor based on the correlation between serum and follicular fluid urea nitrogen. Age, breed and pregnancy status determined the total number of oocytes per cow as shown in the diagram. Adequate serum albumin level of donor cows independently resulted in 46% increased blastocyst formation in the control IVEP protocol ($P = 0.02$). Although protein supplementation of the IVEP protocol did not affect blastocyst formation in oocytes originating from cows with inadequate serum albumin, it independently reduced blastocyst formation by 30% in oocytes originating from cows with adequate serum albumin ($P = 0.02$). Other independent predictors of blastocyst outcome are presented in the diagram.

Comments

This study was approved by the animal ethics committee of the University of Pretoria (V036-16).

Figure 1: Study design

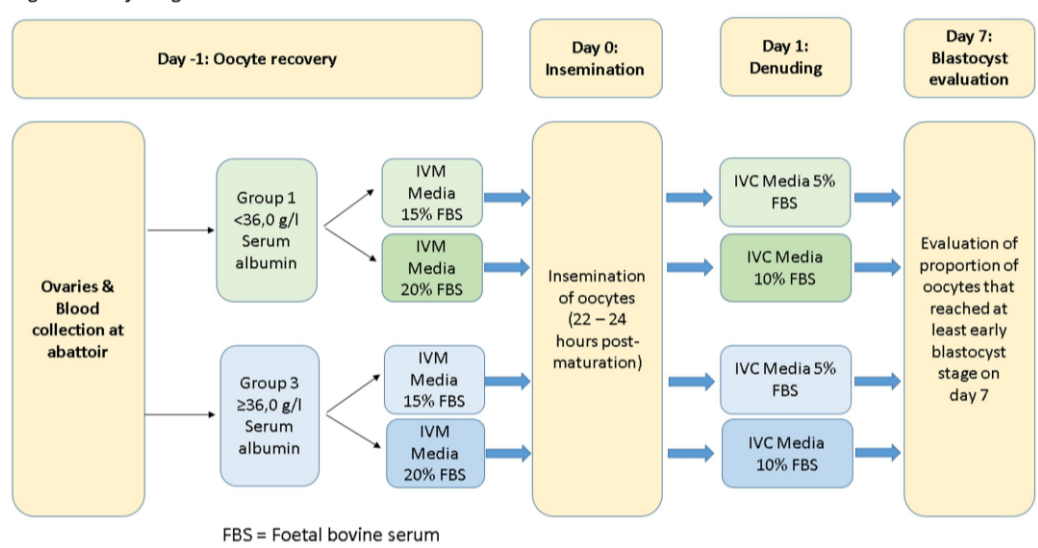
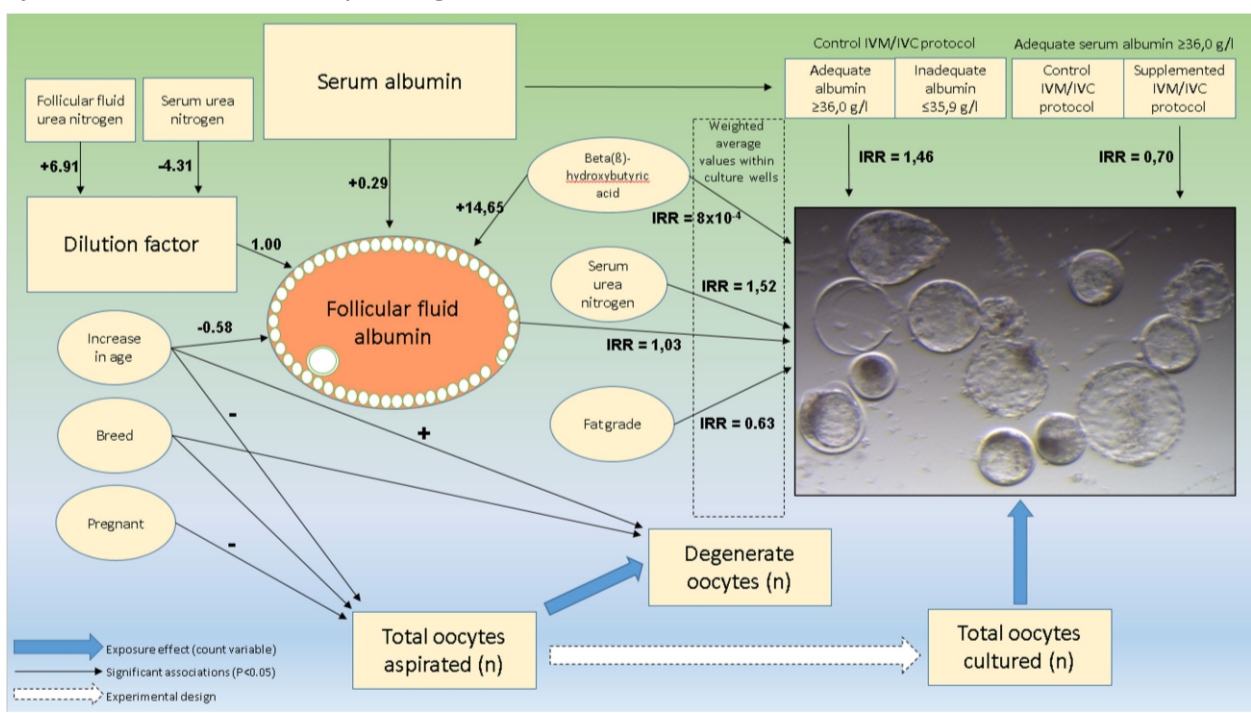


Figure 2: Factors associated with follicular fluid albumin and oocyte quality and developmental competence as detected within this study (numbers or symbols next to arrows indicate the independent regression coefficients or directions; IRR = count ratio; IVM = in vitro maturation; IVC = in vitro culture)



Conclusions

1. This is the first controlled study confirming the negative effect of inadequate serum albumin level of donor cows on developmental competence of oocytes.
2. Further research is required to determine the optimal levels of protein supplementation for in vitro embryo production media when oocytes originate from cows with inadequate serum albumin (≤ 36.0 g/l).
3. Further research is needed to determine the mechanism through which inadequate serum albumin of donor cows result in decreased in vitro developmental competence of oocytes.

