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EFFECTS OF GAS ATMOSPHERES AND GLUCOSE ON THE DEVELOPMENT OF BOVINE EMBRYOS DERIVED FROM IN VITRO FERTILIZATION

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To study the effects of gas atmospheres and glucose on embryonic development, in vitro fertilized bovine one-cell embryos were cultured in a chemically defined medium (modified synthetic oviduct fluid; mSOF) with polyvinyl alcohol instead of bovine serum albumin.

In the first series of experiments, the effects of gas atmospheres and glucose on embryonic development were examined. One-cell embryos were cultured for four days in mSOF with or without 5.56mM glucose under two gas-atmosphere conditions; 5% CO_2 in air or 5% CO_2 – 5% O_2 – 90% N_2, at 39°C. This experiment showed that the gas atmosphere and glucose significantly ($p<0.05$) affected the embryonic development to the morula stage. Both the presence of 5.56mM glucose and 5% CO_2 in air inhibited embryonic development to the morula stage.

In the second experiment, one-cell embryos were cultured for the first four days in mSOF without glucose under 5% CO_2 – 5% O_2 – 90% N_2 at 39°C. Thereafter, the embryos were cultured for another two days in mSOF containing different concentrations of glucose (0, 1.0 and 5.56mM) to examine the effect of glucose on the embryonic development after the morula stage. There was no significant difference in the percentages of blastocysts among the three groups (16.3, 17.3 and 17.5%). However, the mean cell numbers of blastocysts cultured with 1.0 and 5.56mM glucose (128.3 and 127.2 cells) were superior ($p<0.05$) to that in glucose-free medium (91.9 cells).

The present results demonstrate that a gas atmosphere of 5% CO_2 – 5% O_2 – 90% N_2 is superior to the 5% CO_2 in air commonly used for mammalian embryo culture. Glucose at 5.56mM is harmful during the early cleavage stage, but is beneficial for the development of morulae to blastocysts.