Abstract

Culture gas atmosphere is one of the most important factors affecting embryo development in vitro. The main objective of this study was to compare the effects of CO2 concentration on the subsequent pre-implantation developmental capacity of pig embryos in vitro, including embryos obtained via parthenogenesis, in vitro fertilization (IVF), and intracytoplasmic sperm injection (ICSI). Pig embryos were developed in four different CO2 concentrations in air: 3%, 5%, 10%, or 15%. The cleavage rate of pig parthenogenetic, IVF, or ICSI embryos developed in CO2 concentrations under 5% was the highest. There were no significant differences in the oocyte cleavage rate in ICSI embryos in CO2 concentrations under 3% and 5% (p>0.05). However, as CO2 levels increased (up to 15%) the blastocyst output on day 7, from parthenogenetic, IVF, and ICSI embryos, decreased to 0%. These findings demonstrate that CO2 positively affects the developmental capacity of pig embryos. However, high or low CO2 levels do not significantly improve the developmental capacity of pig embryos. The best results were obtained for all of the pig embryos at a 5% CO2 concentration.

Key words: CO2, developmental capacity, pig embryos, in vitro

Introduction

A large number of immature oocytes collected from mammalian ovaries fail to develop to the preimplantation stage after in vitro maturation, fertilization, and culture (Galli et al. 2001, Cognie’ et al. 2004). Pre-implantation development is a time of dynamic change and reprogramming, involving extensive modifications of the genome, proteome, metabolome, and epigenome; hence, the zygotes and embryos are extremely sensitive to the external environment (Marcho et al. 2015). Several factors have been implicated in these failures, including oocyte quality, culture conditions, media, peptide growth factors, amino acids or macromolecules, and culture gas atmosphere (Kane 2003, Merton et al. 2003). Among the factors that affect in vitro embryo development, culture gas atmosphere is considered to be one that is very important. A high grade of follicular vascularity has been shown to be correlated with a higher rate of pregnancy and live births following embryo transfer in women (Chui et al. 1997), suggesting that a threshold oxygen supply is important.