

Optimizing Cell Culture Media for Cultured Meat Production

Animal-free Recombinant Insulin Improves Chicken Skeletal Muscle Cell Proliferation in Serum-free Cell Culture Media

Background

Globally, meat consumption is the highest it's ever been and is projected to double by 2050. Cultivated meat can mitigate the environmental impact of the food system, decrease the risk of zoonotic disease, and, ultimately, feed more people with fewer resources. Although there are dozens of cultivated meat companies around the world, none have yet reached commercial-level production in terms of scale or cost. One of the main challenges is the optimization of a high-performing cell culture media, suitable for animal cells, free of animal-derived materials, and cost-efficient.

This study provides proof of concept that the supplementation of animal-free recombinant insulin to Chicken Skeletal Muscle Cells (SV40) cell culture is critical to alleviate growth limitations observed in serum-free cell culture media.

Study Description

SV40 cells initially cultured in the cell line vendor medium were adapted to DMEM/F12 commercially available media, in the presence of 20% FBS (Fetal Bovine Serum). To find optimal growth conditions to replace serum in the cell culture medium, different growth factors (EGF, bFGF) were supplemented to the serum-free medium, with or without insulin. To identify the concentration of insulin promoting the highest cell proliferation, different concentrations of insulin were compared.

Results

Comparable levels of SV40 cell proliferation were observed in the cell line vendor medium and DMEM/F12 medium supplemented with 20% FBS. As expected, serum-free DMEM/F12 medium did not allow any cell proliferation (not shown). In DMEM/F12 supplemented with the growth factors EGF and bFGF, cell proliferation was still suboptimal. The supplementation of different concentrations of Insulin to the EGF/bFGF-containing medium, strongly improved cell proliferation, already at low concentrations (5µg/ml) (Fig. 1).

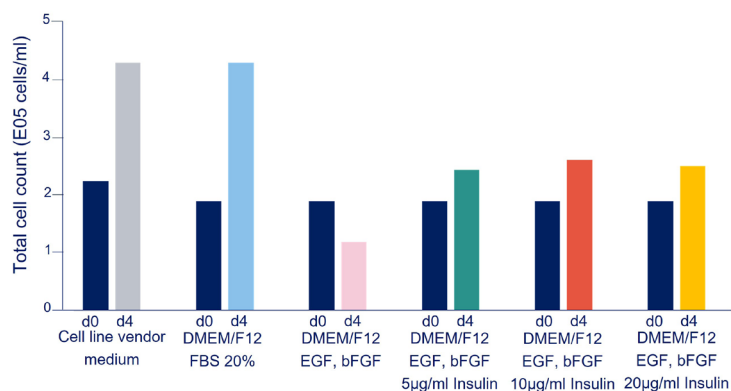


Figure 1: Total SV40 cell number in different growth conditions. Cell proliferation after 4 days in culture was compared in cell line vendor medium (grey), DMEM/F12 + 20% FBS (light blue), DMEM/F12 + EGF + bFGF (pink), DMEM/F12 + EGF + bFGF + 5µg/ml Insulin (green), DMEM/F12 + EGF + bFGF + 10µg/ml Insulin (red), DMEM/F12 + EGF + bFGF + 20µg/ml Insulin (yellow). Blue bars show the cell count on day 0 for all the media analyzed.

Conclusion

- Growth limitations observed in a serum-free commercially available media are alleviated by supplementation of animal-free recombinant insulin
- Already at low concentrations, insulin improves SV40 growth conditions in a serum-free commercially available media
- Supplemented with other selected metabolites, Insulin is crucial to support cell growth for cultured meat

Next Steps

- Evaluation of cell growth of SV40 in serum-free media supplemented with insulin concentrations lower than 5µg/ml
- Evaluation of cell growth of SV40 in serum-free media supplemented with insulin in lab-scale bioreactors
- Development of insulin-based solutions fitting the market demands

Further Information

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