Popular Science Summary

Cultured Meat: A Potential Sustainable and Ethical Solution

Cultured meat production has emerged as a promising solution to address the environmental and ethical concerns associated with traditional meat production. As the global population increases, so does the demand for animal products, necessitating the exploration of sustainable meat production methods. The role of cell culture media in cultivating meat is crucial, emphasizing environmental benefits and ethical implications. Conventional meat production is resource-intensive, contributing significantly to deforestation, greenhouse gas emissions, and water pollution. Cultured meat offers a sustainable alternative that can drastically reduce these environmental impacts. Ethically, cultured meat presents a more humane option by eliminating the need for mass-scale animal slaughter.

To meet the increasing demand for cultured meat, scalable and cost-effective production processes are essential. Cell culture media, a nutrient-rich solution that provides essential support for growing and maintaining cells, play a pivotal role in this, and exploring sustainable sources for its components is vital to mitigate environmental impact. A major challenge is the use of fetal bovine serum (FBS) in cell culture media, which raises ethical concerns and is expensive. FBS is made by collecting blood from unborn calves and processing it to extract the nutrient-rich serum used in cell culture. Investigating alternatives to FBS, with a focus on developing serum-free media, enhances the sustainability and ethicality of cultured meat production.

This project explored algae protein isolates (APIs) as potential serum replacements in cultured meat production and revealed promising avenues. Various methods for extracting proteins from microalgae were tested, emphasizing the balance between optimizing yield and maintaining protein quality. Ultrasonication and alkaline extraction emerged as effective methods. While longer ultrasonication durations generally increased protein yield, they could also degrade protein quality. Balancing yield and quality were crucial for the successful extraction of growth factors needed for cell cultivation.

API development showed promising results, particularly when combining ultrasonication and alkaline extraction. Lowering the concentration of APIs reduced their toxicity and supported better cell growth compared to initial tests. Washing the raw materials to reduce salt content improved cell growth, indicating that high salt content contributed to toxicity. The findings confirmed that algae-derived proteins have the potential to reduce FBS dependency, supporting the development of more sustainable and ethical cell culture media.

Additionally, algae peptide mixtures (APMs) were developed and tested. APMs showed potential in boosting cell growth at optimal concentrations. However, variations in results highlighted the need for further optimization and testing.

Overall, the study suggests that with further refinement, algae-derived protein and peptide extracts could become viable alternatives to FBS, paving the way for more sustainable and ethical advancements in cultured meat production. By reducing reliance on FBS and utilizing sustainable sources for cell culture media, the cultured meat industry can make significant strides toward a more sustainable and humane food production system.