Exploring Marine-Derived Extracts as Ethical, Sustainable, and Cost-Effective Fetal Bovine Serum (FBS) Substitutes

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Fetal Bovine Serum (FBS) is a staple supplement in cell culture, providing key growth factors that promote cell health and proliferation. Cell culture has been a cornerstone of biological science since 1885, advancing both basic and applied research. Unfortunately, FBS presents ethical, scientific, and economic challenges: ~2,000,000 bovine fetuses are sacrificed annually to produce ~800,000 liters of FBS, batch-to-batch inconsistencies hinder experiment replicability, and FBS can account for over 75% of cell culture costs. Thus, identifying viable FBS alternatives is essential for the sustainable future of biological science. Marine sources offer an exciting avenue as FBS alternatives because of their abundance of bioactive compounds and sustainable potential. Novel extracts derived from sea urchin roe (uni) and an invasive algae (Gracilaria salicornia), were evaluated as alternatives to FBS. Extracts were prepared at 5%, 10%, and 20% concentrations, and their impact on HEK293 cells assessed through cell counts, MTT assays, and microscopy over 72 hours. The 5% and 10% uni and 10% algae treatments showed promising proliferation, with cell counts statistically comparable ($p>0.05$) to the FBS control. The 5% uni treatment exhibited the healthiest morphology, achieving up to 84.3% of the FBS control's cell density. Despite the proliferative success, the MTT assay showed significantly lower viability across all treatments ($p<0.001$), suggesting the extracts may lack metabolic factors necessary for cell function. These findings highlight the potential of marine-derived extracts as FBS supplements, with further refinement and exploration needed to determine their full potential.

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