

Emerging of serum-free media based on alternative and sustainable protein sources

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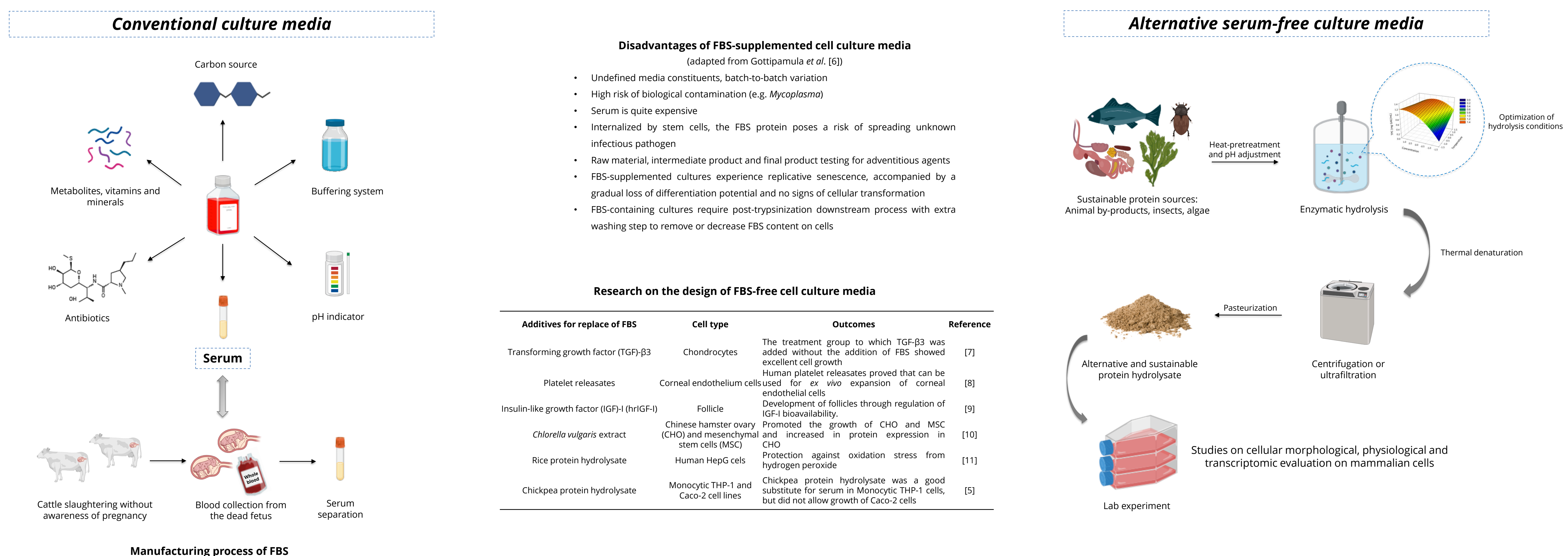
Context

Technological advancements are unceasingly required by the ongoing developments in the sectors of industrial biotechnology and pharmacy. These progresses call for brand-new, highly productive and economically viable culture media formulations based on sustainable sources, with zero or negative carbon footprint [1].

Serum is frequently included in the medium used in cell and tissue cultures. Serum composition includes proteins, lipids, minerals, growth factors and hormones. The addition of fetal bovine serum (FBS) is well recognized procedure for mammalian cell cultures. FBS offers the nutritional and physicochemical elements necessary for cell maintenance and growth, as well as attachment and growth factors. Despite these advantages, FBS still has a number of drawbacks, including low batch-to-batch consistency, a risk of biological contamination by *Mycoplasma*, the need for many cattle and, consequently, an increase in gas emissions [2]. In this context, research studies should be focused especially on several options with which to substitute FBS. So, a recent trend in cell culture is to change from serum-use to serum-free media.

Current alternatives to serum embrace the use of a combination of recombinant proteins (insulin and other growth factors), hormones (hydrocortisone), lipids, and hydrolysates [3]. Protein hydrolysates often comprise a mixture of proteins, peptides, amino acids, minerals, carbohydrates, lipids and growth factors that are similar to the raw input material. These ingredients have been linked to health-promoting properties due to their anti-apoptosis, antioxidant, immunomodulatory effect and antibacterial activities and also have effects on cell proliferation [4]. Chickpea [5], chicken and fish-derived hydrolysates [3] are some potential sources that have been explored as serum replacements for animal cell culture. However, systematic evaluation of protein hydrolysates as an alternative for FBS remains limited. Currently, it is required to conducted studies of sustainable protein hydrolysates (e.g. animal by-products, insect and algae) on cellular morphological, physiological and transcriptomic evaluation on mammalian cells to provide a strong reference for boosting the application of FBS-free media.

Overview



Main conclusions and challenges

- The removal of serum from media cell culture decreases downstream processing time and costs
- Protein hydrolysates comprise amino acids, vitamins and lipids that contribute to the elementary ingredients of cell culture media
- Hydrolysates contain growth factors that enhance cell proliferation
- Bioactive properties of hydrolysates including anti-apoptotic, antioxidant, antimicrobial as well as immunomodulatory effects, are unique features that should be taken into consideration
- Full characterization of hydrolysates, together with an in-depth analysis of the regularly used culture media can be essential to identify their critical components
- The effectiveness of hydrolysates as prospective serum replacement components depends on a deeper knowledge of their constituent parts and how they might affect cell maintenance and proliferation

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