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## BIOCHEMICAL CHARACTERIZATION OF BOVINE PLATELET-RICH PLASMA: A REVIEW

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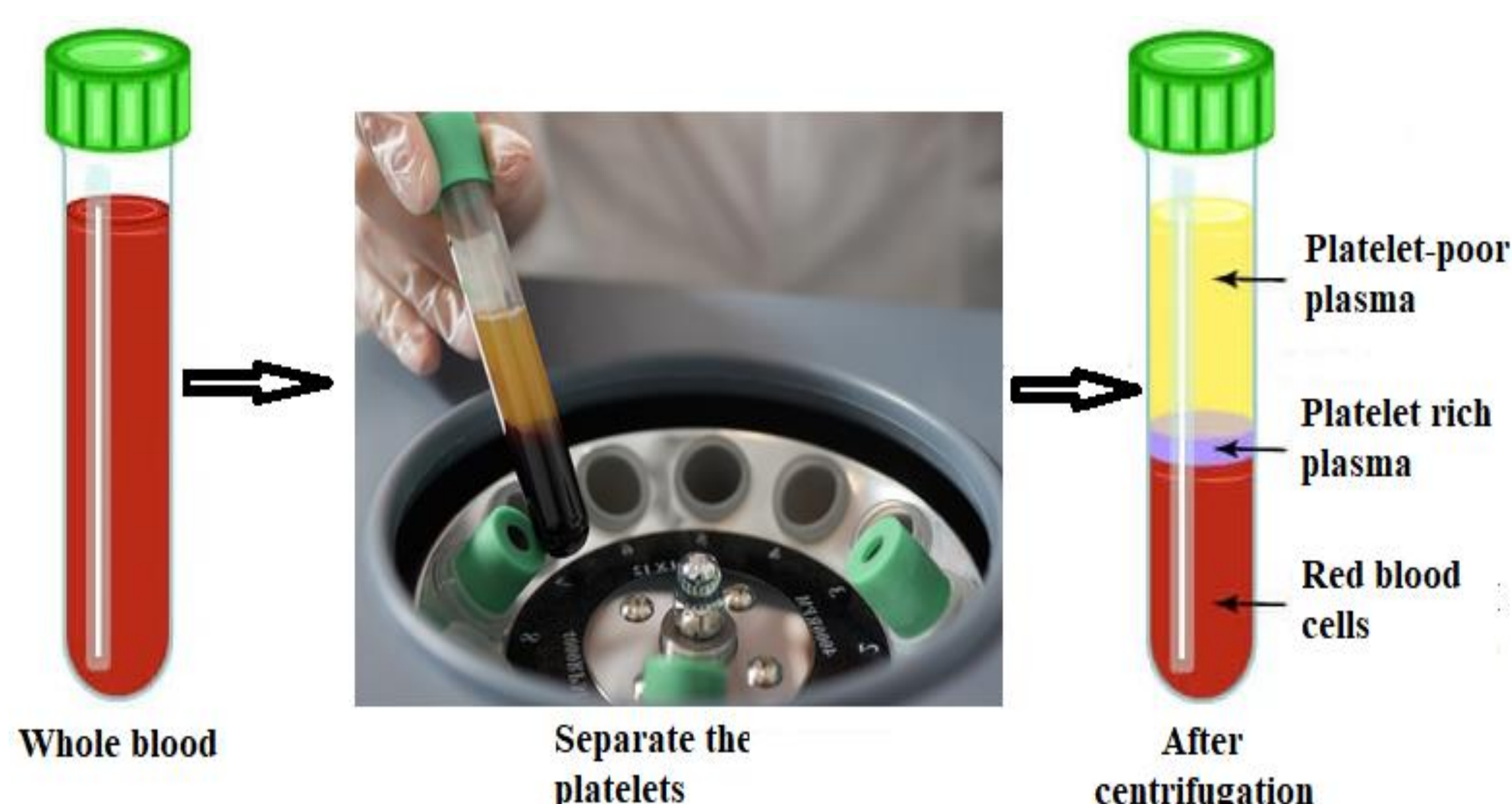
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**Abstract:** Platelet rich-plasma (PRP) is a valuable biological fraction obtained from animal blood, with significant potential in veterinary medicine due to its complex composition, rich in proteins, growth factors, immunoglobulins and bioactive molecules. This review analyzes the chemical composition of PRP and modern characterization methods and techniques such as spectrophotometry, electrophoresis, high-performance liquid chromatography (HPLC) and mass spectrometry. Emerging therapeutic applications of PRP are also presented, especially in the context of bovine gynecological health, where it is used for the treatment of metritis, endometritis and stimulation of postpartum uterine regeneration. Through its immunomodulatory and healing actions, PRP offers a promising alternative to classical therapies, contributing to reducing the use of antibiotics and improving fertility in dairy farms.

### Introduction

- Plasma with a platelet concentration higher than the "normal" physiological level in whole blood is called platelet-rich plasma. Hundreds of bioactive proteins, including a variety of growth factors, are found in the 50–80 α-granules that platelets possess (Anitua et al., 2004; Blair et al., 2009; Neumüller et al., 2015).
- ✓ The most important growth factors are:
  - vascular endothelial growth factor (VEGF);
  - fibroblast growth factor (FGF);
  - platelet-derived growth factor (PDGF);
  - transforming growth factor-beta 1 (TGF-β1);
  - epidermal growth factor (EGF);
  - insulin-like growth factor (IGF);
  - connective tissue growth factor (CTGF);
  - hepatocyte growth factor (HGF).
- ✓ Plasma proteins like fibrinogen, fibronectin and vitronectin support tissue matrix formation and cell adhesion.
- ✓ Immunoglobulins provide passive immune defense.
- ✓ Cytokines and chemokines are involved in the modulation of inflammation and recruitment of immune cells.

These components work synergistically to accelerate tissue repair and regeneration in both soft and hard tissues (Dohan Ehrenfest et al., 2009).



**Figure 1.** Obtaining Platelet-Rich Plasma from blood via centrifugation

### Results and discussions

*Platelet-Rich Plasma* chemical makeup can be thoroughly examined using cutting-edge methods that aid in locating and measuring its bioactive constituents:

#### ▪ Spectrophotometry

This technique calculates the concentration of proteins, growth factors, or other biomolecules by measuring the absorbance of light by PRP at particular wavelengths. It is frequently employed for indirect platelet concentration assessment and total protein quantification.

#### • The process of electrophoresis

Proteins are separated by electrophoresis according to their charge and size. It aids in the identification of particular proteins or cytokines found in the sample, such as important growth factors like PDGF, TGF-β, and VEGF, in PRP analysis.

#### • Liquid chromatography with high performance (HPLC)

HPLC allows for precise separation and quantification of the proteins, peptides, and small molecules that make up PRP. It is extremely useful for analyzing specific growth factors or bioactive compounds derived from platelets.

#### • Mass spectrometry (MS)

Mass spectrometry enables exact molecular identification and quantification of PRP proteins and peptides. PRP from different donors or species can be compared, the proteome profile mapped, and post-translational changes identified.

### Platelet-Rich Plasma therapeutic applications

PRP has shown promise in a variety of veterinary sectors, including orthopedics, wound healing and increasingly reproductive health (Marx, 2001; Everts et al., 2006).

- ✓ Marini et al. in a 2016 *in vitro* study show that PRP promotes endometrial cell growth, upregulates reproductive genes, and reduces pro-inflammatory gene expression, indicating its potential use in treating endometritis.
- ✓ Lange-Consiglio et al. in 2014 demonstrated that platelet concentrate, rich in growth factors, shows promising regenerative and anti-inflammatory effects in bovine mastitis treatment. When used alone or combined with antibiotics, platelet concentrate enhanced tissue repair, reduced somatic cell counts, and lowered relapse rates, particularly in chronic cases, highlighting its potential as an effective complementary or alternative therapy.

### Conclusions

- Platelet-Rich Plasma is a promising physiologically active therapeutic for veterinary medicine, particularly in reproductive applications. By utilizing natural healing mechanisms, it provides a new, antibiotic-free approach for controlling diseases in cattle, with potential benefits to fertility and herd productivity.
- Its diverse immunomodulatory and regenerative properties make it a useful supplement for conventional treatments.