

## The Systemic Effects of Platelet-Rich Plasma Injection

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### Summary:

Serum IGF-1, VEGF and bFGF levels are significantly elevated following PRP injection, supporting a possible ergogenic effect of PRP.

### Abstract:

Background:

Platelet-rich plasma (PRP) is an autologous blood product used to treat acute and chronic tendon, ligament and muscle injuries in over 86,000 US athletes annually. The World Anti-Doping Agency (WADA) banned intramuscular PRP injection in competitive athletes in 2010 due to concerns that it may increase performance-enhancing growth factors. The ban on PRP was removed in 2011 due to limited evidence for a systemic ergogenic effect of PRP, but the growth factors within PRP remain prohibited.

Purpose:

This study aimed to quantify the impact of PRP injection on systemic growth factors with performance-enhancing effects, and to identify molecular markers to detect treated athletes.

Study Design:

Cohort study

Methods:

Six ergogenic growth factors monitored by WADA, namely: human growth hormone (hGH), insulin growth factor-1 (IGF-1), insulin growth factor binding protein-3 (IGFBP-3), basic fibroblast growth factor (bFGF), vascular endothelial growth factor (VEGF), and platelet derived growth factor-BB (PDGF-BB) were measured in 25 patients before (baseline), and 0.25, 3, 24, 48, 72 and 96 hours after intratendinous leukocyte-rich PRP injection. Eating and exercise were prohibited for 3h before testing. Growth factors were quantified by ELISA and the change relative to each individual's baseline was calculated.

Results:

Relative to serum, PRP contained significantly more bFGF (226 vs 5 pg/mL), VEGF (1,426 vs 236 pg/mL) and PDGF-BB (26,285 vs 392 pg/mL), but IGF-1 and hGH were not elevated. Serum levels increased significantly for IGF-1 at 24h and 48h, for bFGF at 72h and 96h, and for VEGF at 3h, 24h, 48h, 72h, at 96h. VEGF was increased in all 25 patients after PRP treatment.

Conclusion:

Serum IGF-1, VEGF and bFGF levels are significantly elevated following PRP injection, supporting a possible ergogenic effect of PRP. An indirect marker for hGH doping, the product of IGFBP-3 x IGF-1, also increased significantly after PRP. Importantly, IGF-1 concentration was lower in PRP relative to serum at baseline, so the observed increase in serum IGF-1 after PRP treatment is likely due to activation of the hGH-IGF-1 axis. VEGF is elevated in all patients after PRP, and >88% of patients had elevated VEGF at each time point from 3 to 96h after PRP, suggesting that VEGF may

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be a sensitive molecular marker to detect athletes recently treated with PRP.