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## **Influence of repeated subcutaneous G-CSF injections on selected blood parameters relevant for monitoring programs in sports drug testing**

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### **Abstract**

The proliferation and differentiation of hematopoietic progenitor cells is regulated by a family of cytokines comprising hematopoietic growth factors such as erythropoietin (EPO) and granulocyte colony-stimulating factor (G-CSF). The use of growth factors in sports is restricted under the terms of World Anti-Doping Agency (WADA) prohibited list. But while the performance-enhancing properties of EPO are well documented and have been extensively studied in the past, other growth factors may also be highly relevant in a doping control context. The cytokine G-CSF has a stimulating effect on granulopoiesis and is clinically used for the mobilization of CD34+ hematopoietic progenitor cells from the bone marrow to the blood. Within this study, the relevance of G-CSF as potential performance-enhancing or masking agent in sports was investigated by analyzing its influence on selected blood parameters monitored in the Athlete Biological Passport (ABP). A total of 20 healthy volunteers (14 x ♂, 6 x ♀) were treated for 5 consecutive days with G-CSF (10 µg/kg/d) and the effect on white blood cell count, red blood cell count, percent reticulocytes, hematocrit, and hemoglobin concentration was determined using fluorescence flow cytometry-based approaches. Additionally, the G-CSF plasma concentrations were measured using a commercial ELISA kit. While all volume-dependent parameters (red blood cell count, hematocrit, hemoglobin concentration) were slightly decreased following medication, both white blood cell count and reticulocyte percentage were found to be significantly elevated. As both parameters are highly relevant for the validity of doping control blood tests, it can be concluded that G-CSF has an obliterating effect on blood profiles and should be a factor considered in case of atypical findings in blood passport analysis.

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