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Erythropoietin- Influence of physical strain and application on concentrations in blood and urine

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Abstract:

The influence of acute physical strain on the spontaneous erythropoietin concentrations in blood and urine of nine athletes (7 males (5 runners, 2 triathletes), 2 females (runners)) was determined.

Blood samples were collected in serum collection tubes (CORVAC) before and up to 45 min. after a non-standardized work-out. Urine samples were collected over two 12 hour periods, beginning around the same time as the blood sampling.

Serum concentrations were determined with a NICHOLS INSTITUTE chemiluminescence immunometric assay for erythropoietin in human serum.

The concentrations found in serum were 14.0±6.4 mU/ml (mean±stdev; range: 7.3 to 26.0) before and 14.8±7.3 mU/ml (mean±stdev; range: 7.5 to 26.3) after physical strain. Other studies found similar values using RIA (Berglund et al 13.6±5.0 mU/ml[1]; Fischer et al 14.2±5.7 mU/ml[2]). The sensitivity of this assay is 1.4 mU/ml as calculated by NICHOLS INSTITUTE Diagnostics BV. The difference between the concentrations before and shortly after physical strain is not significant, which is in good accordance with the literature[3].

Urinary concentrations were also determined with a chemiluminescence immunometric assay.

The concentrations found in urine were 2.7±1.3 mU/ml (mean±stdev; range: 1.1 to 4.9; n=8)for the daytime urines and 1.7±0.9 mU/ml (mean±stdev; range: 0.8 to 2.9; n=6; 3 of 9 samples were below the limit of detection) for the nighttime urines. The limits of detection and determination were 0.6 and 1.3 mU/ml respectively, calculated from the calibration data with a confidence level of 95%. Wide et al found in 11 healthy individuals uEPO concentrations in morning urine of 1.41±0.82 mU/ml (mean ±stdev; range: 0.57 to 3.0)[4].

Furthermore recombinant erythropoietin (RECORMON 1000; BOEHRINGER Mannheim, Germany) was administered to one healthy male athlete. A therapeutical dose of 20 I.U./ kg BW (1400 I.U.) was applicated intravenously around 09:00 a.m. on day 2, 4 and 6 of the study.

Blood samples were collected on days 2 to 6 once around 08:45 a.m. and once around 06:15 p.m.. On application days blood was collected right before the application. On the 9th day one more blood sample was collected around 08:45 a.m..

Urine samples were collected in a 12 hour rhythm beginning in the morning of day 1 and ending in the morning of day 10.

The concentrations found in the daytime urines of the application days were all highly elevated (59 mU/ml on day 2; 50.8 on day 4; 58.3 on day 6). The other daytime urines and all of the nighttime urines showed concentrations of 5.1±1.6 mU/ml (mean±stdev; range: 3.5 to 8.1; n=6; daytime) and 3.0±3.2 mU/ml (mean±stdev; range: 1.0 to 7.7; n=4; 4 of 8 samples were below the limit of detection, nighttime)

The picture for blood is very similar. The blood samples collected in the evening of the application days showed highly elevated levels (80 mU/ml on day 2; 56 on day 4; 62 on day 6), whereas all other samples showed concentrations (26±5 mU/ml; (mean± stdev; range: 21 to 33; n=8) similar to the one measured right before the first application of RECORMON 1000 (23±3 mU/ml; n=2).

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