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Biochemical markers of insulin-like growth factor-I (IGF-I) misuse in athletes

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Abstract

Background: Insulin-like growth factor-I (IGF-I) is reportedly misused by elite athletes, either alone or in combination with growth hormone (GH), despite its presence on the WADA list of prohibited substances. The GH-2000 and GH-2004 research groups previously developed a method for detecting GH misuse but there is no test for detecting IGF-I misuse. The aim of this pilot study was to assess the effect of recombinant human IGF-I (rhIGF-I)/rhIGF binding protein-3 (rhIGFBP-3) administration on serum markers of the GH-IGF axis and on bone and collagen markers.

Design: Randomised, double-blind, placebo-controlled study of 28 days' treatment with placebo or rhIGF-I/rhIGFBP-3 complex (30 or 60mg daily), followed by 56 days' washout.

Subjects: 26 female and 30 male recreational athletes (age 18-30 yrs).

Methods: GH-IGF axis markers (IGF-I, IGFBP-2, IGFBP-3, acid-labile subunit (ALS) and IGF-II) and bone and collagen markers (procollagen type III amino-terminal propeptide (P-III-NP), procollagen type I carboxy-terminal propeptide (PICP), type I collagen cross-linked carboxy-terminal telopeptide (ICTP) and osteocalcin) were measured using commercial immunoassays.

Results: In women, in response to rhIGF-I/rhIGFBP-3 administration, there was an approximately four-fold increase in IGF-I on Day 21 in the high dose group ($P<0.001$). Mean P-III-NP increased by 50% in the high dose group on Day 14 ($P=0.002$) and mean IGFBP-2 approximately doubled in the high dose group on Day 21 ($P=0.0039$). Mean IGF-II decreased by 53% in the high dose group on Day 21 ($P=0.0028$) and mean ALS decreased by 40% in the high dose group on Day 21 ($P=0.0022$). There were no significant changes in IGFBP-3, osteocalcin, ICTP or PICP.

In men, there was a four-fold increase in IGF-I on Day 21 in the high dose group ($P<0.001$). Mean P-III-NP increased by 53% in the high dose group on Day 28 ($P<0.001$) and mean IGFBP-2 approximately doubled in the high dose group on Day 28 ($P<0.001$). Mean IGF-II decreased by 51% in the high dose group on Day 21 ($P<0.0001$). There were no significant changes in IGFBP-3, ALS, osteocalcin, ICTP or PICP.

Conclusions: rhIGF-I/rhIGFBP-3 administration caused an increase in serum IGF-I, IGFBP-2 and P-III-NP, and a decrease in IGF-II in both women and men. ALS decreased in women but not in men while IGFBP-3 and the bone and collagen markers osteocalcin, ICTP and PICP did not respond. The pattern of change in IGFBP-2, IGF-II and ALS will be evaluated further to find the optimal combination of markers for detecting IGF-I misuse.

References

Guha, N., Erotokritou-Mulligan, I., Nevitt, S. P., Francis, M., Bartlett, C., Cowan, D. A., Bassett, E. E., Sönksen, P. H. and Holt, R. I. G. (2013), Biochemical markers of recombinant human insulin-like growth factor-I (rhIGF-I)/rhIGF binding protein-3 (rhIGFBP-3) misuse in athletes. *Drug Test Analysis*, **5**: 843-849. doi: 10.1002/dta.1562