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Serum concentrations of P-III-P and IGF-I in selected populations of athletes

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Introduction

Insulin-like growth factor-I (IGF-I) and procollagen type III peptide (P-III-P) have been proposed as indirect biomarkers of the rhGH misuse [1-2]. To investigate if physiological conditions or training event (intensity of training, competition stress and stress injuries) could affect levels of these two biomarkers, P-III-P and IGF-I were measured in elite athletes, in non-competitive adult athletes in pre and post-race conditions (10 and 20 km races), in young non-competitive athletes, and in non-athletic population, free from rhGH consumption.

Populations and Methodology

Nine different groups of subjects were studied and their characteristics are described in Table I.
Serum IGF-I was measured by the ELISA technique Quantikine Human IGF-I Immunoassay from R&D Systems (Minneapolis, USA), and serum P-III-P was measured by the RIA Intact PIIINP RIA kit from Orion Diagnostica (Espoo, Finland). These immunoassays were selected after an extensive validation aimed to application in doping control [3].
Values are represented as mean ± SD. Variance analysis (Student post hoc test and ANOVA) was calculated for within and between groups comparison on each variable studied using the statistical package SPSS 2001 for Windows, version 11.0.1 (SPSS Inc., Chicago, IL, USA).

Table I. Population groups participating in the study.

Population	Non-athletic population (NAP)	Young non-competitive athletes (YNCA)	Non-competitive athletes (NCA10)	Non-competitive athletes (NCA20)	Taekwondo elite athletes (TEA)	Swimming elite athletes (SEA)	Synchronized Swimming elite athletes (SSEA)	Triathlon elite athletes (TrEA)	Weightlifting elite athletes (WEA)
N (♂/ ♀)	17 (6♂/ 11♀)	20 (10♂/ 10♀)	30♂	33♂	16 (10♂/ 6♀)	12 (3♂/ 9♀)	14 ♀	16 ♂	13 (12♂/ 1♀)
Age range (mean ± SD)	24-52 years old (33±8)	19-30 years old (21±2)	20-32 years old (23±3)	17-27 years old (21±4)	17-27 years old (21±4)	16-21 years old (18±2)	16-24 years old (19±3)	19-37 years old (27±6)	15-26 years old (19±2)
Training (h/week)	0 - 5	2 - 8	10 - 40	-	20	35	25	7 - 25	11
Samples collection	9 and 17 h in the same day	9 and 17 h in the same day	• Basal • Post-10 km race	• Basal • Post-20 km race	• Basal • Training • Competition	• Basal • Training • Competition	• Basal • Training	• Basal	• Basal • Training • Competition

Table II. IGF-I and P-III-P levels in basal conditions (Difference vs Non-Athletic Population (NAP): $p<0.05$: *; $p<0.001$: **.

	NAP	YNCA	NCA10	NCA20	TEA	SEA	SSEA	TrEA	WEA
IGF-I (ng/ml) Mean ± SD	111.1 ± 30.0	180.3 ± 37.0 **	148.8 ± 31.9 **	130.2 ± 35.0 *	197.2 ± 78.3 **	203.5 ± 76.7 **	157.2 ± 44.4 *	135.9 ± 41.3	179.8 ± 56.8 **
IGF-I (ng/ml) Range	63.1 - 163.2	124.4 - 258.8	91.3 - 202.4	68.0 - 226.6	48.4 - 346.3	133.6 - 380.4	85.8 - 246.6	75.4 - 200.8	131.1 - 308.2
P-III-P (ng/ml) Mean ± SD	3.2 ± 0.8	3.9 ± 0.9 *	3.8 ± 1.0	3.8 ± 1.0	4.9 ± 2.0 **	5.9 ± 1.8 **	4.8 ± 1.4 **	-	5.5 ± 3.2**
P-III-P (ng/ml) Range	1.7 - 5.0	2.3 - 5.2	2.2 - 6.0	2.2 - 6.4	2.8 - 8.8	2.7 - 9.7	2.8 - 7.4	-	2.7 - 11.6

Results and discussion

IGF-I population levels

Levels found in all groups subject of this investigation (Table II) were roughly consistent with those described in previous studies (100-400 ng/ml IGF-I) regarding different population groups (age, sex, physical activity) [1, 4-8]. No differences were observed between sample collection times (studied in NAP and YNCA) or gender (studied in YNCA).

Significant differences were found between the NAP and the athletic populations studied (Table II). Although differences in age among the groups may be responsible for some of the differences found, training conditions appear to be relevant (NAP vs NCA20) [8].

Although a significant increase was found between pre and post-race in IGF-I values in the NCA20 group (Figure 1, A), the results obtained for other elite athletes did not show the same trend (Figure 2).

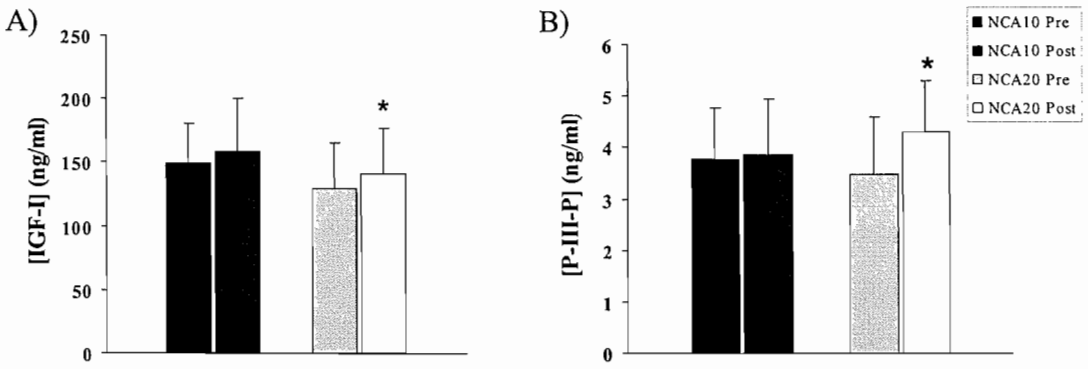

Figure 1. Levels of the indirect biomarkers in pre and post-race conditions (A: IGF-I; B: P-III-P).

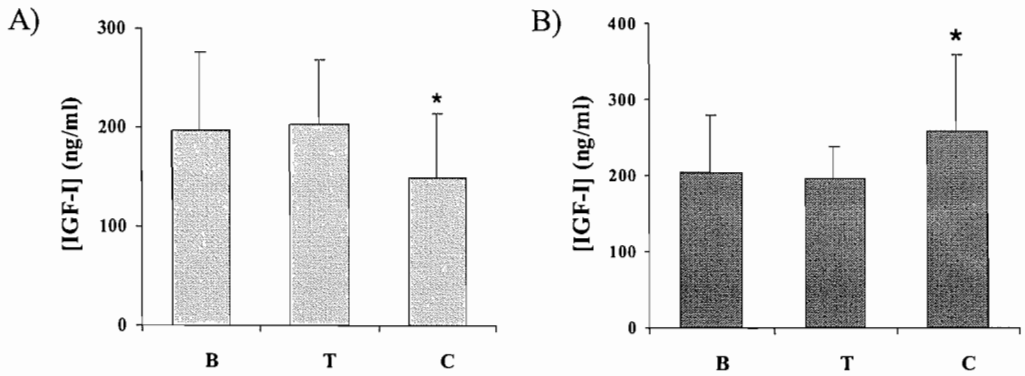

Figure 2. IGF-I levels in basal (B), training (T) and competition (C) conditions in elite athletes (A: TEA group; B: SEA group).

P-III-P population levels

Levels obtained in NAP and YNCA (Table II) were consistent with those described for normal adult population (1,5-4,5 ng/ml P-III-P) and, as in previous studies, neither were gender differences observed [9] nor between sample collection times.

P-III-P basal levels in serum of elite athletes were significantly higher than those found in NAP and YNCA groups (Table II). Although a significant increase was found between pre and post-race in P-III-P values in the NCA20 group (Figure 1, B), the results obtained for other elite athletes in the other studied groups did not show the same trend (Figure 3).

However, nine elite athletes in different conditions presented higher levels of P-III-P (7.4-18.6 ng/ml). These high values seemed to be related with the age of the athletes (between 14 and 18 years old).

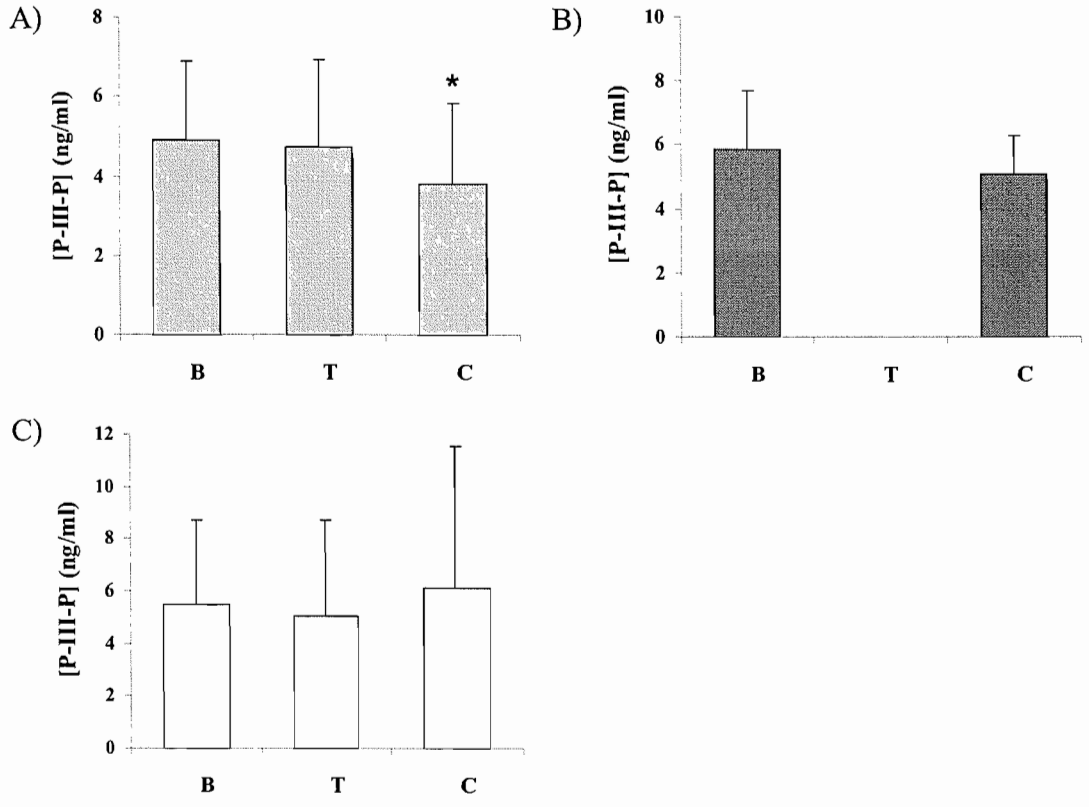

Figure 3. P-III-P levels in basal (B), training (T) and competition (C) conditions in elite athletes (A: TEA group; B: SEA group; C: WEA group).

Acknowledgements

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