A Meta-Analysis of Biomarkers Associated with the Overtraining Syndrome

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Int J Exerc Sci 2(1): S2, 2009. Overtraining (OT) syndrome has been investigated extensively with little agreement as to reliable markers for detection. A meta-analytic review is a procedure designed to compile studies in an area with hopes of reaching a consensus view. **PURPOSE:** The purpose of this meta-analysis was to provide summary quantitative findings of biomarkers (i.e., blood) associated with the overtraining syndrome. **METHODS:** A meta-analytic research design was utilized to investigate selected studies allowing for a coding process to record data. Thirteen studies met inclusion/exclusion criteria. Biomarkers included samples taken with subjects in normal (N) condition and during OT. These biomarkers were the following: glutamine (um), glutamate (um), cortisol (nmo*l^{-1}), IL-6 (nm), testosterone (mg*dL^{-1}), total cholesterol (mg*dL^{-1}), glucose (mg*dL^{-1}), leptin (ng*mL^{-1}), hematocrit (%), hemoglobin (g*L^{-1}), norepinephrine (pg*mL^{-1}), epinephrine (pg/ml), creatine kinase (u*L^{-1}) To determine magnitude of difference between N and OT, the effect size calculation of M_2-M_1/SD_1 was used where M_2 is the mean of the OT sample, M_1 was the mean of the N sample and SD_1 is the standard deviation of the N sample. **RESULTS:** Combined sample size (N) was 238 subjects with the mean time in OT of 6.6 (weeks). The following are mean (SD) of combined subject demographics: height (cm) 175.4 (2.4); weight (kg) 71.7 (2.6); body fat (%) 11.8 (0.9); age (y) 23.5 (2.03); VO_{2max} (ml*kg $^{-1}$*min $^{-1}$) 55.4 (0.8). Mean (SD) biomarker changes from N to OT were the following: Glutamine -56.3 (-2); glutamate 49.7 (2); cortisol -89.7 (-12.2); IL 6 -0.52 (0.12); testosterone -88.9 (-30); cholesterol 4.6 (-1.6); glucose -13.3 (1.9); leptin 0.15 (-0.11); hematocrit -0.83 (-0.4); hemoglobin -20; norepinephrine 36 (-4.1); epinephrine -2.2 (-3.5); creatine kinase 29.2 (8.5). Effect size calculations for the above biomarkers were considered large for the following: glutamine (-4.02), glutamate (8), cortisol, (-1.4), IL 6 (-5.2), glucose (-1.1). **CONCLUSION:** From this analysis, the noted biomarker changes and direction of change (+, -) indicates considerable immune-suppression and increased stress with athletes experiencing the OT syndrome.