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Physiological Variables to Detect Training Distress in Collegiate Soccer Players

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(No relationships reported)

Non-invasive and measureable techniques to identify training distress may be useful to adjust training volume. Traditionally, questionnaire data examining psychological domains have been relied on to detect training distress.

PURPOSE: To examine running performance (shuttle run), resting heart rate and heart rate recovery throughout a soccer season to determine if these physiological parameters can be used to detect training distress in collegiate soccer players.

METHODS: 26 women and 17 men were enrolled in the study. Data were collected at four time points throughout the season (beginning, twice during season and during post-season play). Shuttle run time, heart rate recovery time, resting heart rate values, and multi-component training distress scale (MTDS) questionnaire at each time point. Multivariate analyses were performed with the dependent variable, with time, grade in school and gender as independent variable.

RESULTS: Shuttle run times were prolonged in the beginning and end of season compared to the two mid-season tests ($p<0.001$); heart rate recovery improved throughout the season ($p=0.003$); freshmen deviation from baseline MTDS was greater compared to all other grades ($p=0.001$). Although not statistically significant, resting heart rate values trended up at the end of the season for both genders. MTDS correlated most with shuttle run time and resting heart rate.

CONCLUSIONS: Shuttle run time and resting heart rate appear to be possible variables that could serve as physiological measures for training distress, although it appears higher physical fitness serves as a protective effect against training distress.

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Workload, Energy Expenditure, and Biomarker Differences in Division I Male and Female Soccer Players

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Differential physical demands and physiological responses between males and females in the same sport have rarely been explored.

PURPOSE: To compare work load and biomarker changes in male and female Division I college soccer players through preseason and the first half of the competitive season.

METHODS: Male (N=24; M_{age}= 19 ± 1.1 yrs; $M_{\%BF}$= 11.9 ± 3.2 %) and female (N=26; M_{age}= 19 ± 1.3 yrs; $M_{\%BF}$= 20.9 ± 3.4 %) DI college soccer players participated in blood draws prior to preseason (T1), two weeks into the regular season (T2) and at season's midpoint (T3). The athletes arrived fasted in the morning. T2 and T3 draws occurred ~18 h after a game. Creatine kinase (CK), free cortisol (FC), total cortisol (TC), iron (Fe), growth hormone (GH), and IGF-1 were assessed. Workload (km and kcal/kg) was monitored using the Polar Pro system.

RESULTS: There were no significant changes in TC over time. FC increased from T1 to T2 (Δ FC= 0.34 + 0.1 mcg/dL, P< .05) and remained elevated, particularly for females. There were significant Time x Sex interactions for Fe, GH, and IGF-1 (P<.05). Fe decreased from T1 to T2 (Δ Fe= -29.6 + 7.8 mcg/dL, P< .05) before returning to baseline at T3 in females. CK increased from T1 to T2 (Δ CK= 204.9 + 90.3 U/L, P< .05) before returning to baseline for females and increased from T1 to T3 (Δ CK= 141 + 57.1 U/L, P< .05) for males. GH decreased from T1 to T2 (Δ GH= -2.1 + 0.8 ng/mL, P< .05) and remained below baseline in females. IGF-1 decreased from T2 to T3 in females (Δ IGF-1= -51 + 14.4 ng/ml, P< .05) while males increased from T2 to T3 (Δ IGF-1= 50.8 + 12.5 ng/ml, P< .05). Females had greater total work load (T1-T3) than males (227.6 + 58.6 km vs. 183.2 + 49.2 km; 645.1 + 84.5 kcal/kg vs. 501.1 + 110.5 kcal/kg, P< .05, respectively).

CONCLUSIONS: The increase in FC indicates an elevated stress response, which was particularly pronounced for females. Higher workloads for females in preseason were consistent with earlier elevations in CK compared to males. Additionally, only females had GH changes, suggesting a sex-dependent response. There were also differential changes in IGF-1 across sex. Significant changes in Fe were seen only in females, suggesting unique dietary needs during periods of increased work load. These results suggest differences in training demands and physiological responses for male and female college soccer players.

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Biomarkers of Endocrine, Muscle, and Inflammatory Health Track Training Load of a Collegiate Soccer Season

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Blood biomarkers signal health and performance concerns in athletes. However, serial comprehensive biomarker measurement to detect overtraining in elite soccer athletes remains unstudied.

PURPOSE: To determine if comprehensive biomarker assessment of endocrine, muscle, and inflammatory health change with training progression in collegiate soccer players.

METHODS: A comprehensive panel of 14 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean±SD; height 181±6cm, body mass 77.9±6.2kg, BF% 11.9±2.4%, VO_{2max} 52.9±6.1 $mL \cdot kg^{-1} \cdot min^{-1}$) at 5 time points: prior to the start of preseason (PS), and in season at week 1 (W1), W4, W8, and W12. Blood samples from W1-W12 were obtained 32-34 hours post-match. PlayerLoad (PL) was recorded daily with GPS units. Significant changes in biomarkers over time were assessed via repeated measures ANOVA ($\alpha < 0.05$) and the degree to which biomarkers explained PL were examined using stepwise regression.

RESULTS: Total testosterone (T, mean±SD; $ng \cdot dL^{-1}$) was lower at W1 (588±151) vs PS (665±198, p= 0.029) and W8 vs W4 (565±147, 645±170, p= 0.034). Free T ($ng \cdot dL^{-1}$) was also lower at W1 (103±24) and W12 (99±33) vs PS (127±35, p< 0.025). Free T at W1 (103±24) and W12 (99±33) were decreased vs W4 (125±32, p< 0.022). No differences over time occurred for free cortisol (FC) and total cortisol (TC); however, FC ($\mu g \cdot dL^{-1}$) was elevated at PS, W1, and W4 (1.02±0.41, 1.09±0.17, 0.94±0.35) compared to the reference range (ref.) (0.07-0.93 $\mu g \cdot dL^{-1}$) and TC was elevated W1 (22.1 ± 2.1) vs the ref. (4.6-20.6 $\mu g \cdot dL^{-1}$). Growth hormone (GH), lactate dehydrogenase, SHBG, IGF1, and TSH remained unchanged over time. Creatine kinase (CK) was elevated at W1 (820± 899 $U \cdot L^{-1}$; ref. 44-196 $U \cdot L^{-1}$) and exhibited a main effect for time (p= 0.001) while myoglobin did not change. IL-6 ($pg \cdot mL^{-1}$) was increased W8 vs W1 (1.61±.87, 0.83±0.20, p= 0.007), however IL-1β remained unchanged over time. Changes in PL were explained by T4, A1C, Free T, glucose, GH, and CK (R^2=0.39, β=-0.490, p=0.001).

CONCLUSION: Comprehensive biomarker testing detected reduced FT, elevated TC, and increased CK after PS, consistent with a net catabolic state after PS, without apparent overtraining. Variation (39%) in PL was explained by routine monitoring indicating that these biomarkers track training progression.