

SALIVARY CORTISOL, TESTOSTERONE AND IMMUNOGLOBULIN A CHANGES DURING 3 CONSECUTIVE WEEKS OF TRAINING AND INTERNATIONAL COMPETITION IN ELITE RUGBY UNION PLAYERS

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Competition is a more demanding situation than other strenuous exercise of equivalent duration; it results in greater physiological responses (Elloumi et al., 2003). The object of this study was to evaluate indices of stress and recovery by measuring changes of salivary immunoglobulin A (IgA), cortisol (C), testosterone (T) and the C/T ratio in 10 international rugby union players (mean \pm SEM age 29 ± 1 years, mass 102.4 ± 3.9 kg, height 1.86 ± 0.02 m) during 3 weeks of intensive training and international competition. In November 2006, the England team played games against world-class opposition on 3 successive weekends. Unstimulated saliva samples were collected from players in the early morning (within 2 hours of awakening) following an overnight fast on training days, match days and post-competition days (4 samples per week were obtained from each player). IgA, C, T and transferrin (as a marker of blood contamination of saliva) were assayed using enzyme-linked immunosorbent assay methods (Salimetrics, USA). Data were analysed using 1-way ANOVA and post-hoc t tests.

The initial C (nM)/T (pM) ratio at the start of the first week was 24.1 ± 3.5 . During the first week, with 3 successive training days, C and T levels both increased with an increase in the C/T ratio to 33.2 ± 5.2 ($P < 0.05$ compared with initial values) and returned to basal values by match day following 2 days of training taper. Following defeat in the first match the salivary T decreased from 377 ± 23 pM (on match day) to 184 ± 19 pM (1 day post-match) and remained below 280 pM for the remainder of the second week while C progressively increased resulting in a marked progressive rise in the C/T ratio to 54.5 ± 3.9 ($P < 0.05$ compared with first week). Following a second defeat the training load was decreased for the third week and by the end of this the C/T ratio fell back to 31.7 ± 1.8 ($P < 0.05$ compared with end of second week).

The C/T ratio showed good agreement with players' perceptions of fatigue and stress using the REST-Q questionnaire (Kellmann & Kallus 2001). The third match ended in victory. Salivary IgA concentration remained unchanged throughout the 3-week period (236 ± 31 , 240 ± 19 and 227 ± 24 mg/L in weeks 1, 2 and 3, respectively) and there was no significant change in IgA within each week.

Rugby is a hard physical contact sport and players wear mouth guards during training and match play so we also examined the impact of blood leakage due to microinjury to the oral cavity on the levels of salivary hormones. The presence of blood in saliva indicated by transferrin levels in excess of 20 mg/L (found in 32% of all samples analysed) was associated with significantly higher cortisol concentration (14.3 ± 2.1 versus 11.6 ± 1.6 nM; $P < 0.02$, un-

paired t test) but testosterone (375 ± 57 versus 343 ± 34 pM; $P = 0.25$) and the C/T ratio (40.7 ± 4.8 versus 35.1 ± 5.1 ; $P = 0.07$) were not significantly different to samples with transferrin concentration less than 20 mg/L. The findings suggest ecologically valid minor-to-moderate level microinjuries to the oral cavity have only small effects on the measurement of the salivary C/T ratio and that this marker is a useful measure of training and competition stress in elite rugby players.

References

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