

Monitoring and analysis of training load and physical performance in elite soccer

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BACKGROUND: High-level team sport athletes are exposed to high training loads (TL) [1]. Soccer can be considered as an intermittent high intensity activity where an optimal level of aerobic ($VO_{2max} > 60$ ml/min/kg) and anaerobic fitness is required [2]. This study aims to examine internal TL, using session Rating of Perceived Exertion (sRPE) as proposed by Foster [3], and to evaluate physical performance parameters and its progression in elite soccer players in-season. **METHODS:** An app was developed to monitor TL [sRPE (0 - 10 scale) x session duration (min); AU] in a Belgian soccer team playing at the highest national level during 47 consecutive days. Coaching staff estimated the team's TL after each session. When preseason started and regular competition ended, 16 field players executed a sport-specific test battery including jump, sprint and maximal progressive exercise testing. **RESULTS:** Mean $TL_{session}$ was 223 ± 51 AU and 80 % of the training sessions appeared to happen at low intensity (< 3). Weekly TL differed between no game (777 ± 186 AU), 1 game (1270 ± 295 AU) and 2 games (562 ± 128 AU) a week ($p = 0.019$). Game load (752 ± 125 AU) was higher compared to session loading across training modalities (range, 160 - 621AU) ($p < 0.001$). Similar sRPE-scores were found at low, moderate and high training intensities between coaching staff and players ($p = 0.207$). The VO_{2max} was 60 ± 3 ml/min/kg and decreased by 1.2 % during competition ($p = 0.045$). Sprints and counter movement jump tests did not change significantly ($p > 0.05$). **DISCUSSION:** Mean TL of a Belgian soccer team (223 AU) was in line with that of an English Premier League team (218 AU) [4]. Most training sessions were performed at low intensity, tending towards a polarized training model. Soccer coaches' prescribed and players' experienced sRPE scores may differ [5], but an expert coaching staff correctly evaluated the global training intensity perceived by the players. The VO_{2max} as an important physical performance parameter coincided with the proposed threshold of 60 ml/min/kg for elite soccer players.

REFERENCES: [1] Soligard et al., Br J Sports Med 50 (17):1030-1041, 2016; [2] Reilly et al., J Sports Sci 18 (9):669-8, 2000; [3] Foster, Med Sci Sports Exerc 30(7):1164-8, 1998; [4] Gaudino et al., Int J Sports Physiol Perform 10 (7):860-4, 2015; [5] Brink et al., J Strength Cond Res 24 (3):597-603, 2010

MONITORING AND ANALYSIS OF TRAINING LOAD AND PHYSICAL PERFORMANCE IN ELITE SOCCER

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BACKGROUND

session Rating of Perceived Exertion (sRPE) has been proven a valid tool for monitoring training intensity in elite soccer and can be used to assess internal training load in team sport athletes [1].



Analysis of internal loading in elite soccer players and the estimated loading by coaches during the competition period:

- Does micro periodization depend on the amount of weekly games played?
- Are experienced coaches capable of estimating the training intensity perceived by the players?



Elite soccer players require an optimal level of aerobic and anaerobic fitness, whereas a minimal threshold for the maximal aerobic capacity (VO_{2max}) has been suggested [2].



Evaluation of physical performance parameters and its evolution over a competitive season:

- Is the VO_{2max} of a highly-ranked Belgian team similar to the minimum threshold value for elite soccer?
- Do the physical parameters change over a season?

METHODS

An **app for TL monitoring** and analysis (sRPE x duration of each session) was developed to assess perceived loading per exercise session over 47 consecutive days during competition in soccer players and coaching staff (n = 28).

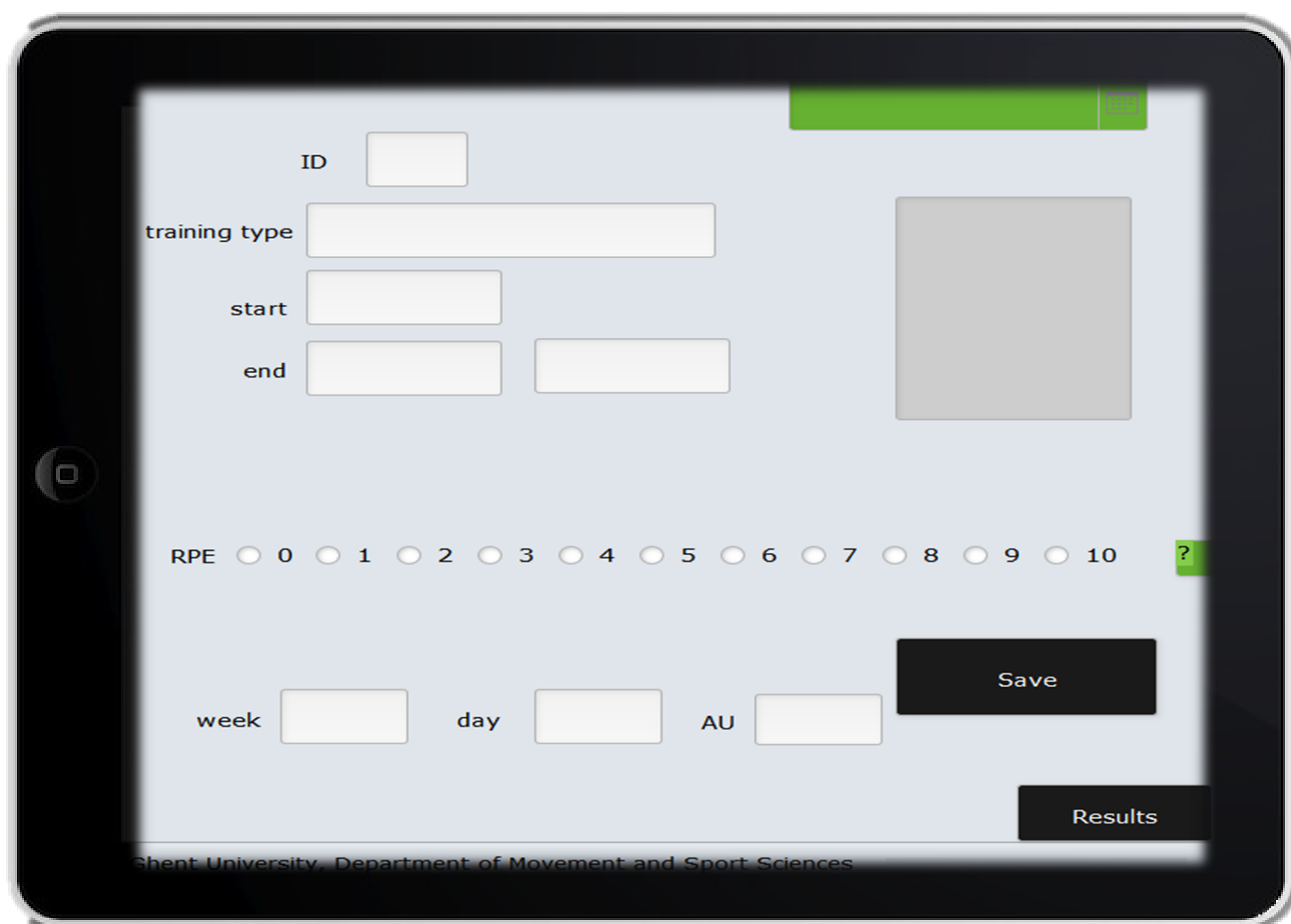


Figure 1. User interface of the custom app (free available on [3]).

A **sport-specific test battery** was completed during pre-season and play-offs in 16 field players of a highly-ranked soccer team competing in the highest national league.

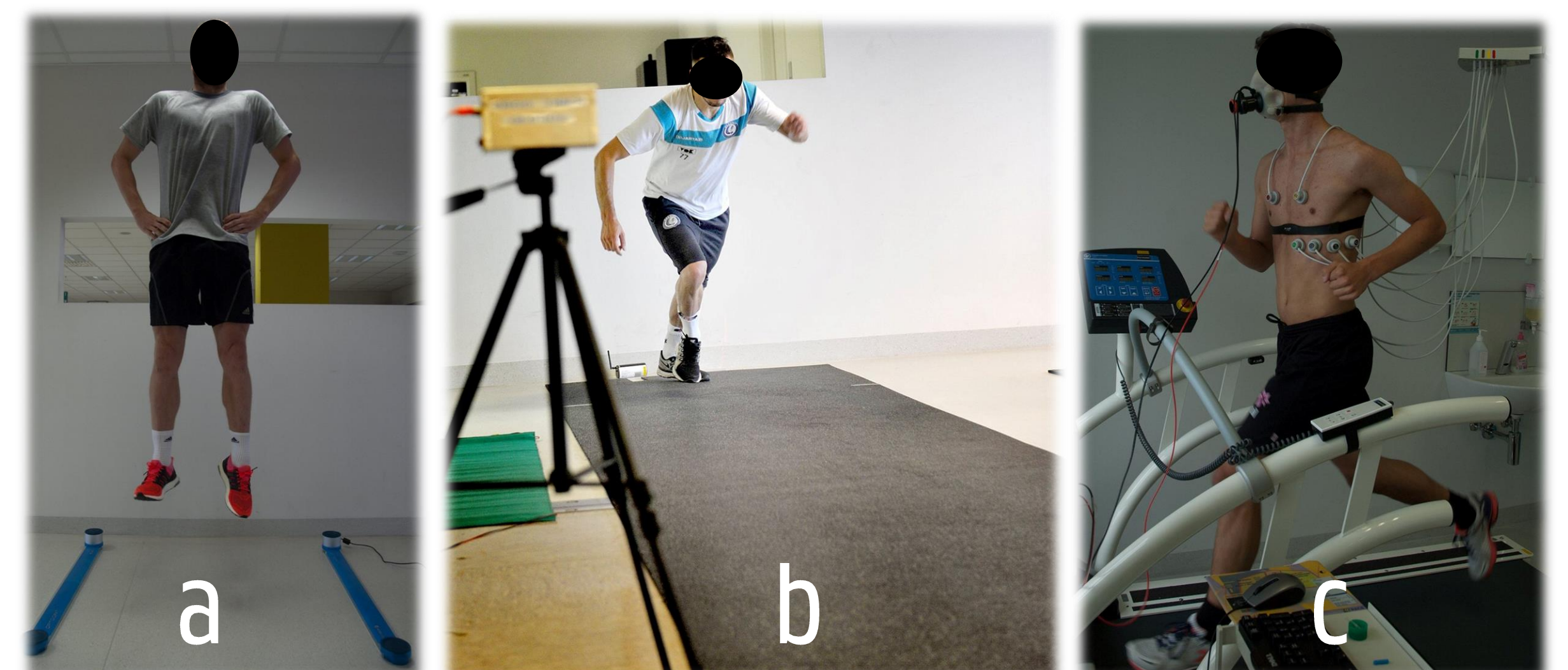


Figure 2. Jump (a) and sprint tests(b), and all-out incremental exercise test with gas exchange measurements (c).

RESULTS

- **Weekly TL was different between** no game (777 ± 186 AU), 1 game (1270 ± 295 AU) and 2 games (562 ± 128 AU) a week ($p = 0.019$). Game load (752 ± 125 AU) was higher compared to training load across training (range, 160 - 621AU) ($p < 0.001$).
- **Similar sRPE-scores** were found at low, moderate and high training intensities **between coaching staff and their players** ($p = 0.207$).

- The VO_{2max} was equal to 60 ± 3 ml/min/kg and decreased by -1.2 % during competition ($p = 0.045$).
- **Anaerobic fitness** parameters as counter movement jump (pre-test, 43.8 ± 4.3 cm) and 5 m (1.43 ± 0.04 s), 10 m (2.16 ± 0.04 s), 5 x 10 m (11.57 ± 0.24 s) tests **did not change** significantly ($p > 0.05$).

CONCLUSIONS

Our findings provide new evidence to support the use of internal loading through sRPE as a global measure of exercise intensity in elite Belgian soccer.

A highly-ranked Belgian soccer team's maximal aerobic capacity is in line with the proposed threshold value for elite players and the anaerobic fitness remained stable during competition in soccer.

References

[1] Gaudino et al., IJSP, 2015; [2] Reilly et al., JSS, 2000; [3] github.com/vdbp

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