

28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Validity and Reliability of a New Wearable Chest-Strap Device to Measure Respiratory Frequency in Elite Soccer Athletes

Di Paco, A., Bonilla, D.A., Perrotta, R., Canonico, R., Cione, E., Cannataro, R.

Casa di Cura San Rossore

INTRODUCTION:

The assessment of the respiratory frequency (fR) has practical importance in monitoring training progress in competitive athletes, especially during exercise. This study aimed to validate a new wearable chest-strap (wCS) device to measure fR against ergospirometry as a criterion device in healthy adults. The gold standard for performance evaluation remains the cardiopulmonary exercise test. However, it remains a test that cannot be applied in daily training practice

METHODS:

A total of 26 elite professional soccer players (23.6 ± 4.8 years; 180.6 ± 5.7 cm; 77.2 ± 5.4 kg) from three Italian Serie A League teams participated in this cross-sectional study. The sample included attackers, midfielders, and defenders. All participants were free of injuries at the time of testing. Participants were equipped with a heart rate sensor (Polar H10, Polar, Kempele, Finland); they wore a face breathing mask connected with a fast-responding gas analyzer (Vyntus Vyaire medical, Chicago, ILL, USA). In addition, they wore a wCS equipped with sensors to read HR and RF and with the newly designed device that tests breath frequency and heart rate, i.e., a belt strap (similar to Polar or Garmin) made of elastic and inelastic materials, and with two internal electrodes, to check the heart rate and with a strain gauge sensor, only with resistive functions, that is used to record the breathing act; it is mechanically and electrically connected, through four snap contacts to a device; hardware cyclically reads the analogic signals created by the internal sensors of the belt and transmit them, after an appropriate collecting filtering to a remote station. The subject underwent an incremental symptom-limited exercise test wearing gas analyzer and chest band simultaneously

RESULTS:

A total of 16529 comparisons were performed after collecting data in the maximal incremental exercise test. No significant differences were found for both methods ($P < 0.05$). Correlation among devices was statistically significant and very large (r [95% CI]: 0.970 [0.970, 0.971], $P < 0.01$; aR^2 [95% CI]: 0.942 [0.942, 0.943], $P < 0.01$). Similarly, a high concordance was found (κ [95% CI]: 0.970 [0.969, 0.971], bias correction factor: 0.999). However, the VyntusTM CPX, as a standard criterion, showed moderate agreement with wCS after Bland-Altman analysis (bias [95% lower to the upper limit of agreement]; % agree: 0.170 [-4.582 to 4.923]; 69.9%). A strong association between measurements (r_{rm} [95% CI]: 0.960 [0.959, 0.961]), a high absolute agreement between methods (ICC [95% CI]: 0.970 [0.970, 0.971]), and a high inter-rater reliability (r_F : 0.947) was found

CONCLUSION:

The new wCS device is an in-field valid and reliable method to evaluate fR compared to a breath-by-breath gas exchange analyzer. The statistical parameters analyzed show a high correlation between the two methods. We are already testing the device in a larger sample. Notwithstanding, caution is advised if methods are used interchangeably while further validation occur

Topic: Training and Testing

Presentation Poster

European Database of Sport Science (EDSS)

Supported by SporTools GmbH



34592