Maximal Heart Rate Varies Across Laboratory, Field Testing, Training, and Match Conditions Among Female Athletes
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Accurate maximal heart rate (MHR) determination is essential for prescribing and monitoring exercise intensity. Although MHR can be determined by a number of testing and estimation methods, minimal conflicting research exists regarding differences between these methods in competitive athletes. **PURPOSE:** To identify if MHR varies between laboratory testing, field testing, training, competitive matches and an age-predicted MHR equation among female collegiate athletes. **METHODS:** 21 female NCAA Division 1 soccer players had MHR determined during a graded, maximal treadmill exercise test (MHRGXT) and a 20-meter shuttle run field test (MHRFIELD) prior to the start of the season, during training sessions (MHRTRAIN) and 5 competitive matches (MHRMATCH) through the first 4 weeks of the season, and by an age prediction equation (208-0.7xage; MHRPRED). Participants were excluded if they were injured during the first 4 weeks of the season or if they failed to obtain at least 2 out of 3 objective criteria during treadmill testing: 1) RER ≥ 1.1, 2) plateau in VO2, and 3) attainment of ≥90% of MHRPRED. MHR was compared across different methods by ANOVA and univariate correlation coefficients were determined between the different methods. **RESULTS:** 15 athletes satisfied the inclusion criteria. Significant differences in MHR were identified between the 5 categories (p= 0.012). MHRGXT (190 ± 3.1 bpm) was significantly lower than MHRFIELD (197.9 ± 7.0 bpm, p<0.001), MHRTRAIN (198.9 ± 5.3bpm, p<0.001), and MHRMATCH (196.8 ± 4.4bpm, p=0.004), but not MHRPRED (193.8 ± 0.7bpm, p=0.12). Significant correlations were found between MHRGXT and MHRFIELD(r=0.89, p<0.001), MHRTRAIN (r=0.822, p<0.001), and MHRMATCH (r=0.584, p=0.02). No differences were identified between MHRFIELD, MHRTRAIN, or MHRMATCH, but all three measures were significantly correlated (r=0.63 to 0.81, p<0.05 for all). MHRPRED was not significantly correlated with any of the other methods (r=-0.216 to 0.137, p>0.05 for all). **CONCLUSION:** MHR from laboratory testing was significantly lower than field testing, training, and competition, although all 4 methods were highly correlated. MHRPRED was not a good predictor of any other MHR measurements. The differences in these methods should be considered when using MHR to prescribe or monitor exercise intensity.