Feasibility of ECG Screening and Bruce Treadmill Testing for Cardiovascular Assessment in Combat Athletes

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Abstract

Background: Practical cardiovascular assessment protocols are needed for combat athletes, particularly in settings where advanced laboratory equipment is unavailable.

Objective: To evaluate the feasibility of integrating resting electrocardiographic (ECG) The study successfully integrated resting electrocardiographic (ECG) assessments into the cardiovascular evaluation process for combat athletes. The present pilot study demonstrated the feasibility of integrating resting electrocardiography (ECG). The study demonstrated that screening with the Bruce treadmill protocol can serve as a standardised framework for cardiovascular assessment using the Bruce treadmill test.

Methods: Competitive boxers, Taekwondo athletes, and Lethwei athletes underwent resting 12-lead ECG screening followed by symptom-limited Bruce treadmill testing. Resting HR, peak HR, HRR-1, blood pressure, exercise duration, and estimated METs were recorded.

Results: The protocol was successfully implemented and allowed the standardised collection of cardiovascular measurements using equipment readily available in clinical settings.

Conclusion: The integrated ECG–Bruce protocol represents a feasible and practical framework for cardiovascular assessment in combat athletes and provides a strong methodological basis for ongoing research.

1. Introduction

Combat sports impose repeated high-intensity physiological demands that result in cardiovascular adaptations affecting autonomic regulation, cardiac function, and exercise performance. Consequently, cardiovascular screening has become increasingly important for ensuring athlete safety and optimising performance.

Resting electrocardiography and Bruce treadmill exercise testing are well-established methods assessment of cardiac function and exercise capacity. However, there has been limited research on the combined use of these methods in a pragmatic, resource-efficient framework. This pilot report evaluates

the feasibility of integrating both assessments as part of an ongoing postdoctoral investigation.

2. Materials and Methods

Study Design and Participants

This pilot feasibility study was conducted as part of an ongoing observational postdoctoral research project involving competitive boxing, Taekwondo, and Lethwei athletes. Participant recruitment is ongoing.

Cardiovascular Assessment Protocol

Following eligibility screening and written informed consent, participants underwent resting 12-lead electrocardiographic (ECG) screening under the supervision of consultant cardiologist before completing a symptom-limited treadmill exercise test using the Bruce protocol (Figure 1). The following cardiovascular outcome measures were recorded using standardised procedures: resting heart rate (HR), peak HR, one-minute heart rate recovery (HRR-1), resting systolic blood pressure (SBP), resting diastolic blood pressure (DBP), post-exercise SBP, post-exercise DBP, total exercise duration, and estimated metabolic equivalents (METs).

Overall Study Workflow

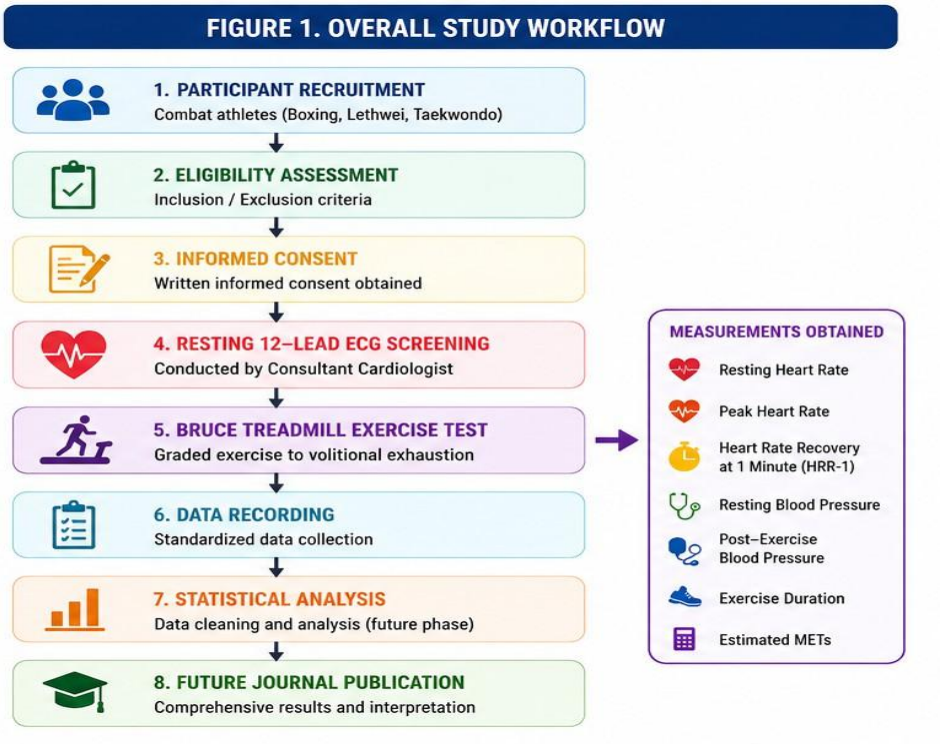

Figure 1. Overall workflow illustrating participant recruitment, ECG screening, Bruce treadmill testing, physiological measurements, and future statistical analysis.

3. Preliminary Progress and Feasibility

The proposed framework for cardiovascular assessment was successfully implemented during the pilot phase. All participants underwent a resting ECG before Bruce treadmill testing. Standardised procedures could record HRR-1, blood pressure response, exercise duration, and estimated METs. These results demonstrate the practical feasibility of implementing the protocol in a resource-limited sports medicine setting. Figure 2. Conceptual framework illustrating the integration of resting ECG screening, Bruce treadmill testing, autonomic recovery, hemodynamic evaluation, and functional capacity assessment

Table 1: Implementation Status of the Proposed Cardiovascular Assessment Framework

Assessment Component	Purpose	Status
Participant Recruitment	Athlete enrollment	Ongoing
Resting ECG Screening	Baseline cardiovascular evaluation	Completed
Bruce Treadmill Testing	Functional exercise assessment	Successfully implemented
HRR-1 Assessment	Autonomic recovery	Successfully recorded
Blood Pressure Response	Hemodynamic assessment	Successfully recorded
Exercise Capacity (METs)	Functional capacity	Successfully estimated
Statistical Analysis	Comprehensive interpretation	Planned after recruitment

Integrated Cardiovascular Assessment Framework

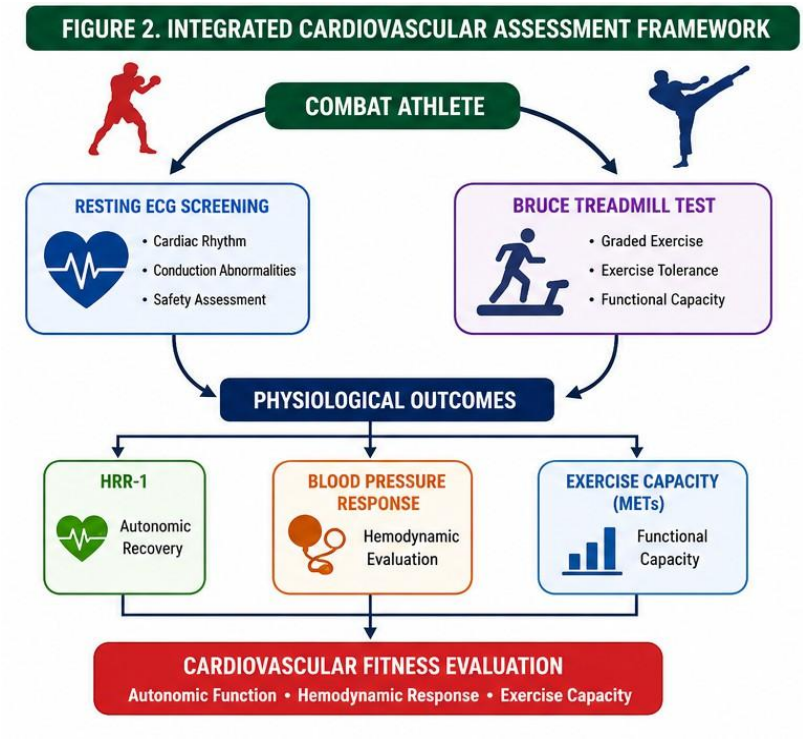

Figure 2. Conceptual framework illustrating the integration of resting ECG screening, Bruce treadmill testing, autonomic recovery, hemodynamic evaluation, and functional capacity assessment.

4. Discussion

The present pilot study demonstrated the feasibility of integrating resting electrocardiography (ECG). screening, the Bruce treadmill protocol as a practical framework for cardiovascular assessment in combat athletes. The aim of the present study was not to report definitive physiological results but to evaluate the operational feasibility and clinical relevance of the proposed protocol.

Successful implementation of resting ECG screening prior to exercise testing reflects the importance of baseline cardiovascular evaluation. The Bruce treadmill protocol provides a standardised method for assessment of exercise capacity, autonomic recovery (HRR-1), and hemodynamic responses. The combination of these complementary assessments provides a thorough but practical approach for the evaluation of cardiovascular function utilising equipment that is typically available in the clinical and sports medicine setting.

This pilot phase confirms standardised cardiovascular data. The pilot phase shows that it is possible to efficiently collect standardised cardiovascular data in a resource-limited setting and thus supports the feasibility of larger-scale investigations. Although the recruitment of participants and statistical analyses are still in progress, the successful implementation of the protocol provides a strong methodological basis for future studies on cardiovascular adaptations in combat athletes. Figure 3. Timeline from literature review to pilot implementation and future

phases in the postdoctoral research project.

Project Progress Timeline

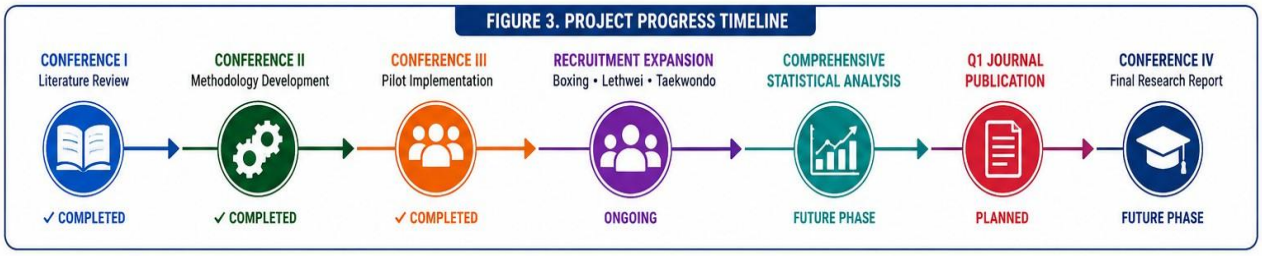

Figure 3. Timeline illustrating progression from literature review to pilot implementation and future phases of the postdoctoral research project.

5. Future Perspectives

The next phase of the project will include:

- Completion of participant recruitment across boxing, taekwondo, and Lethwei.
- Expansion of the study cohort.
- Comprehensive statistical analysis.
- Comparative analyses among combat sport disciplines.
- Writing a full-length manuscript for submission to a high-impact international journal.

6. Conclusion

Resting electrocardiographic screening and Bruce treadmill testing combined provide a feasible, practical, and scientifically sound approach to cardiovascular screening in combat athletes. The successful implementation of the protocol demonstrates that the collection of comprehensive cardiovascular data can be effectively done with standardized procedures and available clinical resources. Successful implementation of the protocol demonstrates that standardized procedures and commonly available clinical resources can be used to efficiently obtain extensive cardiovascular data. “The success of the protocol shows that standardized procedures and readily available clinical resources can collect comprehensive cardiovascular data. The success of this protocol shows that comprehensive cardiovascular data can be efficiently collected using standardized procedures and widely available clinical resources. Successful application of the protocol shows that comprehensive cardiovascular data can be collected efficiently by standardized procedures and an easily available clinical resource. These findings provide a solid methodological basis for further data collection and future study of autonomic and hemodynamic adaptations in combat sports.

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