Integrating Real-World Field Data in Sports Science Research: A Call to Action for a Scientific Research Perspective Transition

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1. Introduction

Exercise and sports sciences continue to grow as a collective of disciplines exploring a broad array of basic and applied research questions (1, 2) with a notable shift from traditional laboratory settings to data collection in real-world sports environments (1-4). This transition is determined by the recognition that lab-based studies, while valuable, often do not fully capture the complexities and dynamics of contextual parameters of sports performance (3-6). Real-world data offers a comfortable, more nuanced understanding of the factors influencing athletic performance. For instance, studying athletes in their natural training environments can provide insights into how different training regimens affect performance, or how athletes respond to environmental stressors (4, 7). Applied research utilizing the Real-world data methodology explores physical performance and health in depth, leading to novel methods for improving athletic talents. A new paradigm has emerged that emphasizes the analysis of data obtained from training to make inferences and identify practical applications (3, 4). This paradigm advocates for a multidisciplinary approach to sports research (1). Unfortunately, this approach is not without its difficulties and challenges (4). Collecting data in the field requires

careful consideration of methodological rigor, ensuring that the data gathered is both accurate and relevant (4, 5, 8). For example, when monitoring an athlete's response during a competition or training, researchers must consider factors like the invasiveness of data collection methods and their potential impact on performance (2, 8). Additionally, the variability of external conditions and covariables such as weather, and equipment differences can introduce complexities in data interpretation (9). It's essential to account for these factors to ensure the conclusions drawn are valid and reflect the true performance dynamics (2, 8, 9).

This editorial aimed to (i) establish a comprehensive framework for research methodology in applied exercise and sports sciences, (ii) discuss the benefits of field-based data collection for providing contextually relevant insights into athletic performance, and (iii) address the practical and ethical challenges in this research area, offering strategies to manage these issues and advocating for realistic, multidisciplinary applied research in sports science.

2. Development of Research based on Data collected from training

The trend towards research based on Data collected from training, ignited by Aaron Coutts' revolutionary on rugby players in the early 2000s (10), further supported by Mujica's

work on tapering, and reinforced by ongoing research by Buchheit in soccer has become a significant paradigm adopted by researchers globally. The tendency to focus on integrating data from real training sessions and competitions into scientific manuscripts has significantly enhanced our comprehension of athletic performance, especially in high-performance sports (4). This approach, firmly based on data gathered during regular training sessions, provides a unique and valuable perspective. Clear statements like " The data of this study was collected as part of the players' daily training monitoring duties" demonstrate a commitment to direct applicability in the real world (3). This move integrating data from real training sessions and competitions signifies a pivotal advancement in sports science research, introducing more immediate practical applications and fostering a deeper understanding of athletic performances. Instead of strictly adhering to an evidence-based approach, there is a call to promote an "evidence-led" or "informed-practice" approach, prioritizing context over simplistic scientific conclusions (3).

This shift in paradigm provides a clear and immediate understanding of the physiological dynamics of an athlete's body in real-world situations. The foundational elements of this transformation are based on a variety of tools to monitor both internal and external workloads.

The subjective rating of perceived exertion (RPE) method, alongside sophisticated technologies including the monitoring of heart rate variability (HRV), Global Positioning Systems (GPS), video analysis, and wearable devices. These instrumental tools facilitate a meticulous examination of athletes' responses to diverse training loads, thereby elucidating pivotal facets of performance (2, 5, 8, 9). For instance, the RPE method helps determine the performed workload and quantify both monotony and acute workload (8). Comprehensive analysis of HRV, allows for the assessment of autonomic nervous system activity, providing insights into an athlete's recovery state and readiness to perform (2, 8). GPS data offers quantifiable data on an athlete's movement patterns and covered distance at different speed zones or thresholds during training and competition (2, 8). This information is crucial in designing training programs that optimize performance while minimizing the risk of overtraining and injury (8). However, implementing these technologies in field settings poses methodological challenges. The variability of external conditions, such as weather and terrain, demands robust data collection protocols to ensure the accuracy and reliability of the data. Furthermore, interpreting this vast amount of data

necessitates sophisticated analytical techniques, especially when collecting data simultaneously. Sports scientists must be skilled at employing advanced statistical methods to parse through the data, identifying meaningful patterns that can inform training adjustments. Incorporating a multidisciplinary approach, sports scientists are increasingly collaborating with experts in nutrition, psychology, and biomechanics to provide a comprehensive overview of an athlete's training response. This holistic perspective ensures that training regimens are not only physically appropriate but also consider the psychological and nutritional needs of the athlete.

The potential for integrating machine learning and artificial intelligence in analyzing this complex data is immense. These technologies promise to revolutionize our approach to training by enabling the prediction of performance outcomes and the early detection of potential injuries. Thus, the ongoing evolution in sports science research methodology, with its emphasis on real-world data collection, holds the key to unlocking new frontiers in athlete performance optimization.

3. Realistic Advantages of Data Collection

One defining element of this approach is the use of data collected during real training sessions and competitions, bringing researchers closer to athletes' real-life experiences. Statements like "This data was collected during the team's usual training period" reflect this commitment to real-world applicability. Gathering data during regular training sessions and competitions enhances the authenticity of sports science studies. Researchers may effectively address real-world difficulties and obtain valuable knowledge that connects with athletes, coaches, and sports enthusiasts by collecting data in the actual training and competition environments. Nonetheless, there are still non-positive opinions, as mentioned in a recent editorial (6) that states "I avoid interactions with researchers because they often fail to effectively address the issues that impact my daily work". When an identical comment arises, there are two possible explanations: (i) the professional in the field simply don't like and don't want to work with academic and (ii) sports scientists are doing a bad job. Either way, researchers should be able to improve their ability to provide a better link between science and practice because there are other scenarios where interaction between researchers and coachers exists, but still, coaches just don't use that knowledge by stating that science is "too general". However,

while the strategy of collecting data in real-world contexts has significant advantages, it also presents challenges and key considerations for realistic data collection.

Transitioning to field-based data collection in sports science presents several challenges, which can be categorized as:

3.1. Methodological Rigor:

Data must be collected using precise and reliable methodologies, ensuring the highest data quality. For example, external load is usually collected via GPS, global navigation satellite systems, local positioning systems, and inertial measurement units. Those types of equipment belong to micro-electro-mechanical systems (which provide a combination of 3D magnetometers accelerometers and gyroscopes). However, there are different technologies with different frequencies (e.g., 10, 15, and 20 Hz) which may provide different outcomes of distances covered at different running intensities, accelerations, decelerations, player load, and others (2, 8).

3.2. Contextual Documentation:

Detailed documentation of the data collection context, including location, weather conditions, and training/competition loads, is essential to understand the impact of these factors on athlete performance.

3.3. Athlete Safety:

Ethical principles must be respected, and athlete safety should always be a priority during data collection.

3.4. Ethical Compliance:

Consent from athletes and participants must be obtained before collecting personally identifiable data, to ensure ethical compliance (4). This should be emphasized since some research now states it as a usual practice of the club in which professional athletes are obligated to let the coach and their staff to collect and analyse data. Additionally, maintaining data confidentiality at each stage of the research procedure is imperative and must be guaranteed.

3.5. Measurement Accuracy:

Calibration of tools and measurement devices is necessary to guarantee the accuracy of collected data.

3.6. Challenges and Collaboration:

In the face of difficulty accessing teams during training and occasionally intervening to ensure methodological rigor, resistance from the coaching staff may arise. Close collaboration between the sports science research departments and sports teams is imperative in this context (4). Adopting effective communication, overcoming challenges, and cultivating strong relationships between scientists and coaches can pave the way for productive research collaborations (1, 2, 6).

3.7. Multidisciplinary Approach:

Sports and physical performance are complex fields influenced by a multitude of factors beyond mere physical conditioning, psychological, nutritional, environmental, and sociological aspects are crucial to an athlete's performance. To comprehensively understand and interpret collected data, a multidisciplinary approach is indispensable. This approach involves collaboration across different scientific domains, including physiology, psychology, nutrition, and sociology. Researchers work together to analyse how these various factors interact and impact an athlete's performance. This collaboration fosters a holistic understanding of the complex interaction of diverse elements, facilitating more comprehensive and precise interpretations of results. As an example, some editorials focus on different load monitoring strategies such as external/internal load and wellness monitoring and how can they relate to healthcare (8, 9).

4. Conclusion

This editorial highlights a crucial shift towards field-based, data-driven research in sports science, complementing traditional laboratory research. While advocating for this progressive approach, it's important to note that we are not suggesting a complete transition away from laboratory-based methods. Laboratory research has its unique benefits, particularly in controlled experimental conditions. The goal is to establish a more balanced methodology where field-based data becomes a primary tool, complemented by laboratory analysis. This dual approach promises a comprehensive understanding of athletic performance, aligning theoretical research with practical applications to optimize training, prevent injuries, and enhance overall athlete health. Our call to action is for a synergistic fusion of field and laboratory research, driving forward the evolution of sports science.

Consent for Publication

Not applicable.

Authors' Contributions

MSF: Conception and drafting of the manuscript
MSF and RFSO: Critically revised it for intellectual content.
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Declaration

None.

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