Recovery Management In Sport:
Overview And Outcomes Of A Nine-Year Multicenter Research Program

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Running heading:

Recovery Management in Sport

Keywords:

Training Load, Training Effects, Fatigue, Training Monitoring, Competition Monitoring, Training Plan, Recovery Strategies, Recovery Interventions, Recovery Techniques, Recovery Methods, Athlete, Regeneration

Please cite as:

Wiewelhove, T., Schneider, C., Kellmann, M., Pfeiffer, M., Meyer, T., & Ferrauti, A. (2024) Recovery management in sport: Overview and outcomes of a nine-year multicenter research program. *SportRχiv*.

This is the accepted manuscript version of the article:

Wiewelhove, T., Schneider, C., Kellmann, M., Pfeiffer, M., Meyer, T., & Ferrauti, A. (2024) Recovery management in sport: Overview and outcomes of a nine-year multicenter research program. *International Journal of Sports Science & Coaching* (Article first published online: January 31, 2024). Copyright © The Authors 2024. https://doi.org/10.1177/17479541241227527

Abstract

The nine-year multicenter research project, titled *REGman* – Optimization of Training and Competition: Management of Regeneration in Elite Sports – aimed to advance the understanding of recovery management in sports and generate practical recommendations. In this article, we outline the overarching research program that links the specific research strands and outputs during the two federal funding cycles (2012-2021) and summarize the main project findings. The two-stage conceptual framework involved investigating monitoring measures for short-term fatigue and recovery, as well as assessing the efficacy of various recovery interventions. These interventions encompassed psychological relaxation and recovery strategies, sleep, cooling techniques like precooling, percooling, cold water immersion, or whole-body cryotherapy, compression garments, active recovery, stretching, heating interventions such as sauna or contrast water therapy, massage, and foam rolling. The findings revealed inconclusive or marginal effects of recovery interventions at the group level, while indicating possible interindividual differences in responses. Additionally, the findings highlighted the effectiveness of diverse monitoring measures, showing satisfactory sensitivity in tracking performance changes related to fatigue and recovery. The use of individualized reference ranges significantly improved classification accuracy compared to group-based reference ranges. Athletes and coaches are encouraged to prioritize fundamental aspects of training and recovery: meticulous training planning and execution, effective sleep management, and proper nutrition. Furthermore, monitoring and analyzing individual responses, even though it demands suitable methodologies and presents challenges in high-performance sports environments, can yield valuable insights for personalized recovery management. If these aspects are comprehensively addressed, and resources allow, additional recovery strategies might be explored.

1 Background

Ensuring a sufficiently high training quality and thus training effectiveness has always been the focus of sport science and practice. Especially in high-performance sports, this focus has been expanding in recent years and includes additional measures aimed at performance enhancement. This has increasingly shifted the focus to optimizing recovery management with the goal of maintaining an optimal balance between stress and recovery and avoiding overloading. The long-term goal is to ensure a positive performance development by planning and completing training or competition loads only while considering the current level of fatigue or performance readiness and supporting the restoration of performance through various recovery interventions.

Recovery management in sports includes monitoring of training and competition, as well as planning and implementing recovery interventions (Figure 1). Training and competition monitoring involves frequent and comprehensive documentation of external and internal training and competition loads, as well as the resulting training effects (e.g., physiological adaptations) and changes in sport performance outcomes. According to Jeffries et al.[1], p. 714, external training and competition load refers to "what the athlete does" (e.g., the number of kilometers run), while internal training and competition load typically refers to the internal responses experienced by an athlete during exercise, training, or competition (e.g., heart rate response or Rating of Perceived Exertion)[2]. Training effects include acute and chronic positive and negative effects that occur after training or competition at different psychophysiological levels (e.g., muscle soreness), while sport performance outcomes (i.e., the performance in the competition) are a result of the balance between positive and negative training effects and influenced by contextual and individual factors such as genetics, environment, psychological states, etc.[1] Training and competition monitoring is regarded as an essential component in the process of individualizing training planning by informed decisions, controlling training and competition loads, and determining if responses are progressing as intended, or if the program needs to be modified.[1,3]

The application of recovery interventions aims to support recovery processes and provides the opportunity to increase training quality and tolerance, support competition performance, and accelerate the restoration of performance after exhaustive training or competition. Athletes and coaches are confronted with an increasing number of recovery interventions and trends with predominantly unclear evidence. Despite a lack of evidence of efficacy, some purportedly recovery-promoting products (e.g., cannabidiol spray) and technologies (e.g., massage gun) have made their way into the sports bags of many athletes thanks to clever (social media) marketing strategies.

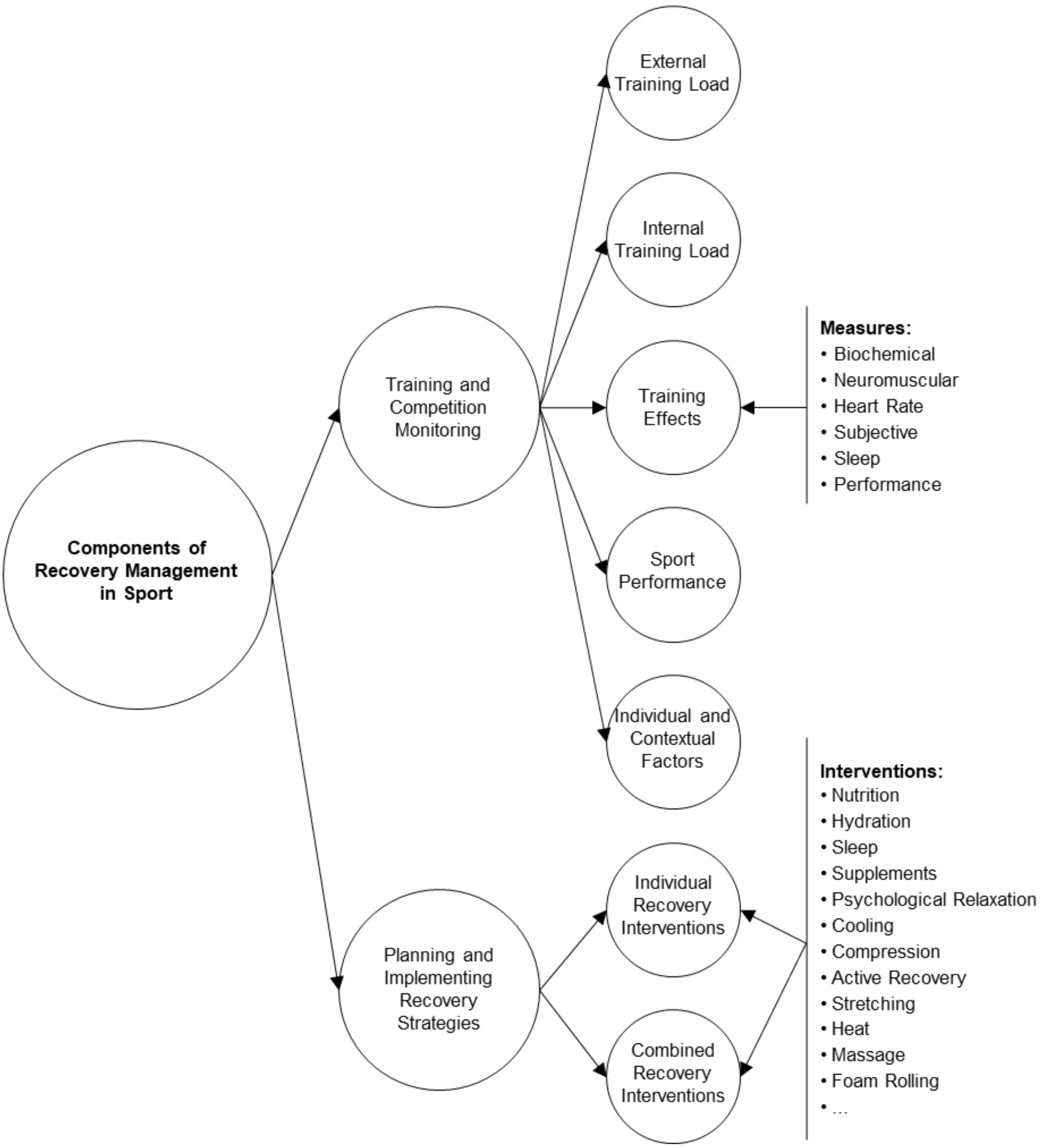

Figure 1 Components of recovery management in sport.

The aim of the nine-year multicenter research project entitled *REGman* – Optimization of Training and Competition: Management of Regeneration in Elite Sports – was to expand the knowledge of recovery management in sports and to derive recommendations for sports practice. The project was funded by the German Federal Institute of Sport Science (BISp) from 2012 to 2021 and was carried out by the University of Saarland, Ruhr University Bochum, and Johannes Gutenberg University Mainz. The aim of this article is to present the conceptual framework of the research program and link the publications that have arisen from the project. Additionally, it aims to derive general conclusions on training and competition monitoring, as well as the application of recovery interventions in sports.

2 What is the conceptual framework of the research program?

The research program's conceptual framework featured a two-stage structure, with each stage building upon the other in terms of content and chronology. Both stages comprised numerous self-contained research modules that could be attributed to either the primary research strand or the accompanying research strand (e.g., preliminary investigations) (Figure 2). All journal publications stemming from the research project are enumerated in Table 1 and thematically linked to the corresponding investigative modules. Alongside these two primary stages, a range of actions were implemented (e.g., hosting workshops for coaches and practitioners) to facilitate the integration of theory into practice throughout the project's duration.

The objective of the initial phase of the research program was to explore the usefulness and accuracy of various monitoring measures in capturing fluctuations in short-term fatigue and recovery stemming from training and competitive workloads (Project Module: Measures for Training and Competition Monitoring).[4–31] This phase was complemented by the development and validation of two concise self-report tools for assessing recovery and stress in sports, namely the *Acute Recovery and Stress Scale* (ARSS) and the *Short Recovery and Stress Scale* (SRSS),[32–37] which have been used in most of the studies. As a preliminary step and as part of preparatory trials, we devised and assessed training protocols that induce temporary fatigue in athletes while maintaining an acceptable level of tolerability (Project Module: Fatigue-Inducing Exercise Protocols).[38–40]

The objective of the second phase of the research program was to determine whether diverse recovery interventions, either independently or in combination during or after training or competition, could enhance both recovery and performance. It also aimed to assess whether potential responses could be consistently observed at both the group and individual levels (Project Module: Recovery Interventions).[41–63] This stage was accompanied by investigations into whether post-training recovery methods might impact training adaptations (Project Module: Recovery Intervention and Training Adaptation),[64,65] and whether the time course of recovery from fatiguing exercise and the effects of recovery interventions would vary based on the age and sex of the athletes.[59,66] Furthermore, observational field data were collected to evaluate how training and competition loads, as well as factors such as sleep and travel, influenced the recovery-stress status of athletes (Project Module: Observational Studies).[67–71] In this second phase, the monitoring measures developed and/or identified as sensitive and accurate in the first stage of the research program were employed. Moreover, to gauge the efficacy of recovery interventions, several studies utilized training protocols designed and assessed in the first stage to induce a tolerable state of fatigue.

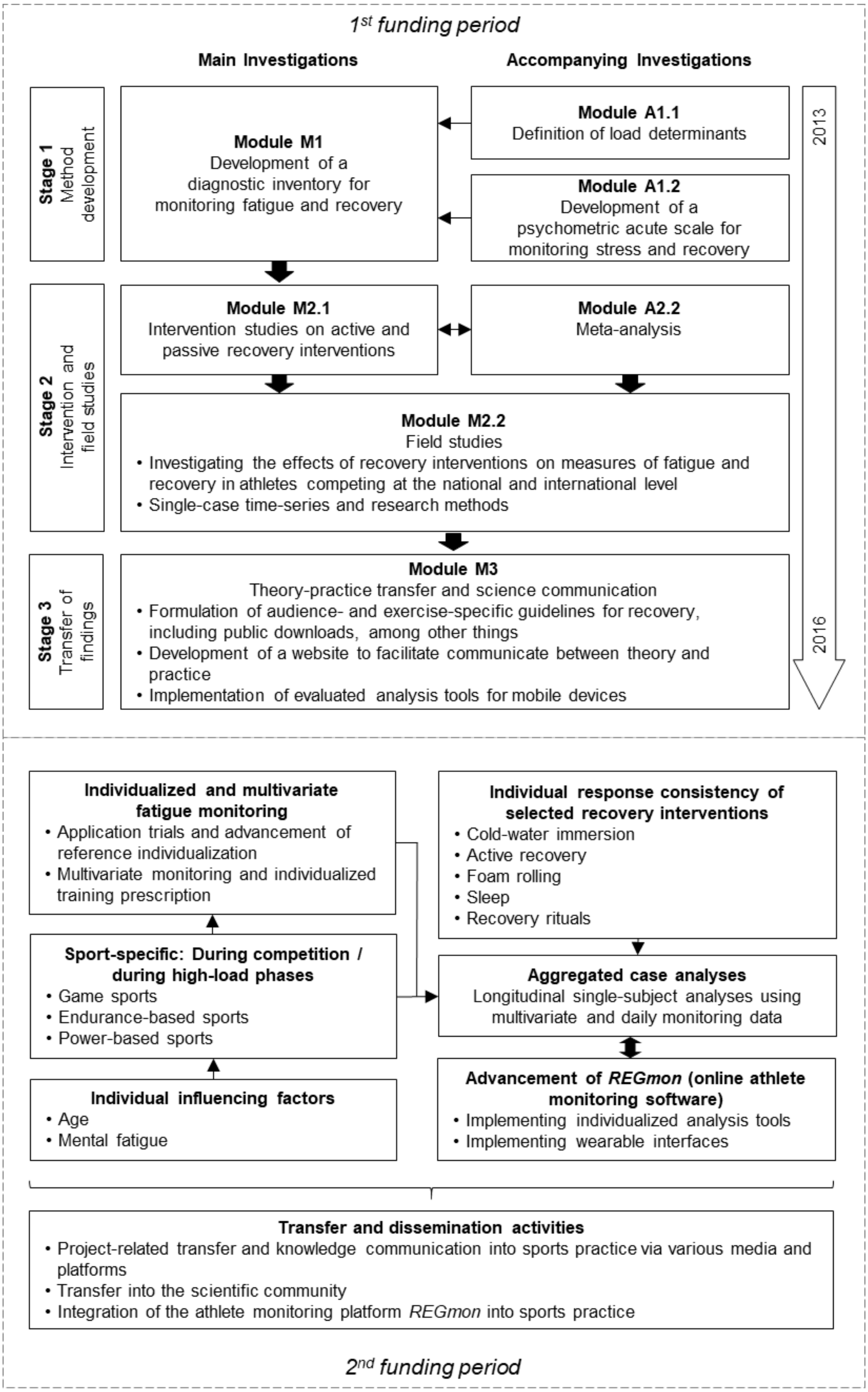

Figure 2 Overview of the project structures and research programs of the two consecutive funding periods at the time of grant application (adapted with permission of the German Federal Institute of Sport Science from Meyer et al.,[72] p. 9, and Meyer et al.,[73] p. 7).

Table 1 Original Research and Review Articles Published within the Nine-Year Research Program.

Reference	Year	Article Type	Running Title
Project Module: Measures for Training and Competition Monitoring			
Meyer et al. [4]	2013	Literature Review	The Measurement of Recovery and Regeneration Requirements in Football
de Paula Simola et al. [5]	2015	Original Research	Tensiomyography and Prediction of Changes in Muscle Force
Hitzschke et al. [32]	2015	Original Research	Development of the Short Recovery and Stress Scale for Sports
Kölling et al. [33]	2015	Original Research	Validity of the Acute Recovery and Stress Scale
Skorski et al. [8]	2015	Original Research	Influence of Fatigue on Pacing Patterns
Wiewelhove et al. [9]	2015	Original Research	Assessment of Fatigue in High-Intensity Training
de Paula Simola et al. [24]	2016	Original Research	Changes of Muscle Mechanical Properties After One Week of Intensive Training
Hammes et al. [10]	2016	Original Research	LSCT: Indicating Fatigue and Recovery
Hecksteden et al. [11]	2016	Original Research	Blood-Borne Markers of Fatigue in Competitive Athletes
Hecksteden et al. [12]	2016	Original Research	miRNAs and Sports
Hitzschke et al. [26]	2016	Original Research	Development of the Acute Recovery and Stress Scale for Sports
Kölling et al. [6]	2016	Original Research	Sleep Monitoring of a Six-Day Microcycle
Kölling et al. [7]	2016	Original Research	Comparing Subjective to Objective Sleep Parameters
Reader et al. [13]	2016	Original Research	Assessment of Fatigue in Heavy Strength Training
Hecksteden et al. [14]	2017	Original Research	Individual Ranges for Markers of Muscle Recovery
Hitzschke et al. [15]	2017	Original Research	Psychological Measures for the Assessment of Recovery and Stress
Julian et al. [16]	2017	Original Research	Individual Patterns in Blood-Borne Indicators of Fatigue
Nässi et al. [17]	2017	Systematic Review	Psychological Tools for Athlete Monitoring
Nässi et al. [34]	2017	Original Research	Development of Two Short Measures for Recovery and Stress in Sport
Schneider et al. [18]	2018	Literature Review	Contextualizing HR Measures: Methods and Applications
Barth et al. [23]	2019	Original Research	Individualized Monitoring in Badminton
Kölling et al. [20]	2019	Original Research	Modification of Questionnaires
Schneider et al. [21]	2019	Original Research	HRV Monitoring During Overload Training
Hof zum Berge et al. [19]	2020	Original Research	Portable PSG for Sleep Monitoring in Sports
Kölling et al. [29]	2020	Original Research	Validation of Recovery and Stress Scales in three English-Speaking Regions
Schneider et al. [22]	2020	Original Research	Monitoring Heart Rate During Standardized Warm-Up in Elite Badminton Players
Hacker et al. [25]	2021	Original Research	Recovery-Stress Response of Blood-Based Biomarkers
Hof zum Berge et al. [27]	2021	Original Research	Portable Polysomnography for Sleep Monitoring
Hof zum Berge et al. [31]	2021	Original Research	Assessment of Sleep Quality and Daytime Sleepiness in Ice Hockey Players
Hof zum Berge et al. [28]	2022	Original Research	Validation of the German Version of the Athlete Sleep Behavior Questionnaire
Skorski et al. [30]	2022	Original Research	Individualized Reference Ranges for Markers of Muscle Recovery Assessment
Project Module: Fatigue-Inducing Exercise Protocols			
de Paula Simola et al. [38]	2015	Original Research	Strength Training and Tensiomyography
Raeder et al. [39]	2016	Original Research	Responses to Different Squat Exercise Protocols
Wiewelhove et al. [40]	2016	Original Research	Acute Responses and Muscle Damage in HIIT

Table 1 (Continued)

Reference	Year	Article Type	Running Title
Project Module: Recovery Interventions			
Poppendieck et al. [41]	2013	Meta-Analysis	Cooling and Performance Recovery
Meyer et al. [42]	2014	Literature Review	Regenerative Interventions in Professional Football
Fullagar et al. [43]	2015	Literature Review	Sleep and Recovery in Team Sport
Kölling et al. [44]	2016	Literature Review	Sleep in Sports
Pelka et al. [45]	2016	Systematic Review	Relaxation Techniques in Sports
Poppendieck et al. [48]	2016	Meta-Analysis	Massage and Performance Recovery
Wiewelhove et al. [49]	2016	Original Research	Active Recovery During High-Intensity Interval Training
Pelka et al. [46]	2017	Original Research	Effects of Psychological Relaxation Techniques
Pelka et al. [47]	2017	Original Research	Interruptions of Recovery
Raeder et al. [50]	2017	Original Research	Active Recovery for Elite Olympic Weightlifters
Schimpchen et al. [51]	2017	Original Research	Cold Water Immersion for Elite Power Athletes
Zinner et al. [52]	2017	Original Research	Compression Clothing During Recovery
Wiewelhove et al. [53]	2018	Original Research	Effects of Different Recovery Strategies Following a Half-Marathon
Kölling et al. [54]	2019	Literature Review	Sleep-Related Issues in Athletes
Loch et al. [55]	2019	Systematic Review	Mental Recovery Strategies for Short Rest Periods in Sports
Skorski et al. [56]	2019	Original Research	Effects of Sauna on Recovery
Wiewelhove et al. [57]	2019	Meta-Analysis	Effects of Foam Rolling
Loch et al. [58]	2020	Original Research	Effects of Mental Recovery Strategies
Hottenrott et al. [66]	2021	Narrative Review	Age- and Sex-Related Differences in Recovery
Schmidt et al. [59]	2021	Original Research	Recovery in Young and Master Athletes
Wiewelhove et al. [60]	2021	Original Research	Active Recovery on the Next Day
Wiewelhove et al. [61]	2021	Original Research	In-Play Cooling During Simulated Tennis Match Play
Wiewelhove et al. [62]	2022	Original Research	Recovery During and After a Tennis Tournament
Loch et al. [63]	2023	Original Research	Mental Recovery Strategies in Simulated Air Rifle Competitions
Project Module: Observational Studies			
Fullagar et al. [70]	2016	Original Research	Travel, Sleep, and Recovery in Football
Fullagar et al. [71]	2016	Original Research	Sleep and Recovery After Night Matches in Elite Football
Kölling et al. [67]	2016	Original Research	Sleep-Wake Patterns Before the World Rowing Junior Championships
Kölling et al. [68]	2017	Original Research	Sleep and Jet-Lag During the 2015`s World Rowing Junior Championships
Collette et al. [69]	2018	Original Research	Training Load and Recovery-Stress State in Swimming
Project Modul: Recovery Intervention and Training Adaptation			
Wiewelhove et al. [64]	2018	Original Research	Active Recovery and Training Adaptation
Poppendieck et al. [65]	2020	Original Research	Cold-Water Immersion and Strength Training Adaptation

To facilitate the translation of theory into practice, we authored two open-access booklets with a practical focus[72,73] and contributed various articles to coaching and applied journals. Additionally, we arranged symposia at the conclusion of each project phase to convey the main findings to professionals engaged in German elite and high-performance sports. Video recordings of the presentations and plenary discussions were made accessible via DVD and/or YouTube. Moreover, an online monitoring platform initially designed for internal project data collection was developed.[74] In response to frequent requests, we further improved the platform to offer support to German elite and high-performance sports teams and training groups, providing them with an athlete-centric, adaptable online monitoring tool. This tool allows for personalized configuration of monitoring and analysis processes, while athletes retain full control over access permissions to their data. Thanks to supplementary funding, the monitoring platform is now also accessible as open-source software (GitHub: https://github.com/REGmon-project/regmon; Website: https://regmon-project.org). All pertinent publications and outreach endeavors stemming from the *REGman* project are cataloged in the corresponding Zotero web library (https://www.zotero.org/groups/4684535/regman/library). A thoroughly organized PDF version of the library, containing hyperlinks to open-access versions of the publications, is accessible in our associated repository (https://doi.org/10.17605/OSF.IO/UZ4AF).

3 What are general findings on the training and competition monitoring?

During the initial phase of the research program, a diagnostic inventory of measures designed to monitor short-term fatigue and recovery was developed. A selection of potentially valuable monitoring measures was compiled from existing literature, considering their plausibility and practicality for consistent integration into sports practice. These measures were assessed for their capacity to monitor responses associated with fatigue and recovery during and after short-term training microcycles (Project Module: Measures for Training and Competition Monitoring). These microcycles encompassed six days, each comprising eleven training sessions involving either high-volume cycling, running-based high-intensity interval training, or whole-body strength training.

The usefulness of the various monitoring measures was assessed with regards to their sensitivity to change and external responsiveness (as outlined in Impellizzeri & Marcora[75]): The average changes in the monitoring measures were expected to mirror the average changes in training-specific criterion performance measures (sensitivity to change), and ideally, individual changes should also exhibit correlations between monitoring measures and criterion performance tests (external responsiveness). Table 2 illustrates our assessment of the usefulness of the various measures, demonstrating an acceptable degree of sensitivity in tracking fatigue and recovery-related performance changes. This diagnostic inventory was then employed in subsequent studies to appraise the effectiveness of diverse recovery interventions.

However, it is worth acknowledging that we consistently observed inadequate correlations between changes in monitoring and performance measures. On one hand, this suggests that monitoring measures could not reliably predict criterion performance outcomes in the context of our short-term overload training microcycles. On the other hand, our findings regarding sensitivity to change (i.e., capturing group-level changes) substantiate the hypothesis that short-term fatigue and recovery responses are multifaceted, likely to differ among individuals, and according to Jeffery et al.'s framework[1], indicative of measures of (acute) training effects that are conceptually distinct from performance outcome measures. Consequently, during periods of demanding training, alterations in one or more psychophysiological domains (signifying training effects) can be anticipated, while performance outcomes may or may not be affected.

Table 2 Monitoring measures which showed acceptable sensitivity to change for different types of overload training microcycles (adapted with permission of the German Federal Institute of Sport Science from [72], p. 106).

<table>
<tr><th rowspan="2">Measures</th><th colspan="3">Exercise Modality</th></tr>
<tr><th>High-Volume and High-Intensity Endurance Training</th><th>Whole-Body Strength Training</th><th>Running-Based High-Intensity Interval Training</th></tr>
<tr><td rowspan="2">Functional or Performance-based</td><td rowspan="2">Submaximal Exercise Tests (e.g., LSCT)</td><td>Strength Tests* (e.g., MVIC)</td><td>Linear Sprint Tests* (e.g., 20 m)</td></tr>
<tr><td colspan="2">Jump Tests* (e.g., CMJ, MRJ)</td></tr>
<tr><td rowspan="2">Subjective</td><td colspan="3">ARSS, SRSS for Continuous Monitoring (Overall and Physical Scales/Items)</td></tr>
<tr><td></td><td colspan="2">Visual or Numerical Scales for DOMS</td></tr>
<tr><td rowspan="3">Physiological</td><td>Urea, IGF-1, Free Testosterone (FT)* FT/Cortisol*, ACTH/Cortisol*</td><td></td><td></td></tr>
<tr><td colspan="3">Creatine Kinase, C-Reactive Protein*</td></tr>
<tr><td colspan="3">Resting HR & HRV* (RMSSD)</td></tr>
<tr><td rowspan="2">Others</td><td colspan="3">Sleep</td></tr>
<tr><td></td><td colspan="2">Tensiomyography*</td></tr>
<tr><td colspan="4">ACTH = Adrenocorticotropic Hormone, ARSS = Acute Recovery and Stress Scale, CMJ = Countermovement Jump, DOMS = Delayed Onset Muscle Soreness, HR = Heart Rate, HRV = Heart Rate Variability, IGF-1 = Insulin Like Growth Factor 1, LSCT = Lamberts and Lambert Submaximal Cycle Test, MRJ = Multiple Rebound Jumps, MVIC = Maximal Voluntary Isometric Contraction, SRSS = Short Recovery and Stress Scale, * = Restricted recommendation (e.g., only statistically significant fatigue response or statistically significant responses only for a selection of metrics). For details see original publications [6,9,10,11,13,15,21,24,72].</td></tr>
</table>

Lastly, an analysis methodology was formulated for the personalized monitoring of blood-based muscle recovery markers, specifically creatine kinase and urea[14]. This procedure employs a Bayesian framework that utilizes normative data established at the group level as prior information, enabling the creation of individualized reference ranges as repeated measurements from fatigued and recovered states become accessible at the individual level. This individualized approach demonstrated enhanced classification accuracy when contrasted with group-based reference ranges, as demonstrated in endurance athletes, badminton players, and soccer players.[14,23,30] Spreadsheets for executing this analysis method using one's own data are available as supplementary materials accompanying the original publication.[14]

4 What are general findings on the use of recovery interventions in sports and exercise?

While our research studies have shown low to trivial levels of statistical evidence for the effectiveness of common recovery interventions (e.g., psychological relaxation and recovery strategies, sleep, cooling interventions such as precooling, percooling, cold water immersion, or whole-body cryotherapy, compression garments, active recovery, stretching, heating interventions such as sauna or contrast water therapy, massage, and foam rolling) at the group level, in individual cases, these techniques may be relevant for restoring performance. In this regard, our research has demonstrated that certain athletes may derive greater benefits from a specific recovery strategy than others. This means that, on the one hand, the individual needs, preferences, and beliefs of athletes should be considered when planning their recovery. However, we also demonstrated that even if an individual perceives a recovery technique as beneficial, it could still be trivial or even detrimental to the recovery process, or vice versa. Therefore, on the other hand, the effectiveness of recovery strategies for an individual athlete should be examined at both subjective and objective levels in high-performance sports (e.g., based on training and competition monitoring data) to determine whether a given tool or device can be used as a recovery method. As mentioned in the previous section, individual responses may be inconsistent within athletes and therefore need to be observed in replication to be identified as a true individual response pattern and thus meaningful.

The intensity, duration, and type of exercise (i.e., training load), as well as individual (e.g., genetics, psychological traits and states, training background) and contextual factors (e.g., training or competing in hot conditions, altitude training), are all factors that contribute to unique psychophysiological fatigue responses.[1] According to Thorpe[76], it is crucial to identify the specific psychophysiological stress caused by an exercise stimulus at any point along the recovery continuum in order to prescribe an effective recovery strategy. For example, cooling interventions such as cold water immersion (CWI) or whole-body cryotherapy have the potential to mitigate secondary damage resulting from mechanical stress,[77] while heating interventions such as sauna bathing or hot water immersion have been shown to increase tissue temperature, blood flow, and metabolism, thereby reducing metabolic-associated fatigue.[76,78] After a session of repeated sprints or (reactive) strength training, which can be expected to cause muscle damage, a recovery approach that initially focuses on reducing secondary damage through cooling interventions followed by heating interventions once the inflammatory cascade subsides may be recommended. Conversely, swimming performed at high intensities or for extended periods may not produce enough trauma producing muscular stress to require cooling as an initial recovery strategy.[79,80]

Furthermore, in order to promote potential positive or prevent negative interactions with training adaptations, recovery interventions should not only be individualized and specified, but also appropriately periodized. A good example of this is the use of CWI. According to a recent review article by Ihsan et al.,[81] the inclusion of regular CWI recovery into a resistance training program can attenuate the magnitude of anabolic signaling and protein synthesis. This attenuation ultimately leads to a reduced magnitude of strength and muscle mass gain. Therefore, the use of CWI after resistance exercise should be discouraged. However, the authors also note that emerging data shows no impairments in strength gains in athletes who use CWI regularly during intensified training periods. They suggest that this either indicates that the recovery benefits of CWI may outweigh its dampening effects on hypertrophy response, or that the negative effects of CWI on strength and muscle mass can be avoided by programming CWI following technical or aerobic conditioning sessions. Therefore, the use of CWI may be incorporated during competition or intensified training but should be strategically avoided immediately after training sessions focused on improving muscle strength or hypertrophy.

In addition to a systematic, individualized, and periodized recovery process that matches appropriate recovery strategies to associated psychophysiological fatigue symptoms, the available evidence on the effectiveness of recovery interventions should also be considered. Firstly, the body of literature on recovery methods continues to grow, and new findings and conclusions may emerge in the future. Secondly, literature findings examining the effectiveness of recovery tools are rather inconclusive, with applied research showing improved, unchanged, or even impaired recovery of fatigue markers following the use of a recovery strategy. This means that even if a review or meta-analysis cannot show an average effect for a recovery intervention, there may still be a relevant effect of a recovery strategy for a particular sport, a specific target group, or a certain recovery protocol. For instance, an increasing number of studies and reviews are assessing potential dose-response relationships for recovery interventions, aiming to specify the most effective protocol of a recovery intervention for reducing fatigue.[82–86]

5 Conclusions

To summarize, drawing from the original investigations, reviews, and meta-analyses conducted within this nine-year multicenter research project, the studied recovery interventions predominantly yielded uncertain or minimal to minor effects on enhancing specific facets of the recovery process. We also encountered some evidence of potential variability in fatigue and recovery responses among athletes. As a result, athletes and coaches can be recommended to prioritize the fundamental components of training and recovery management: meticulous training planning and execution, effective sleep management, and proper nutrition. Furthermore, monitoring individual training as well as fatigue and recovery responses may prove beneficial in identifying scenarios where adjustments to training and recovery are warranted. If these aspects are comprehensively addressed and additional time and resources are available, then exploring supplementary recovery strategies (e.g., cold water immersion, compression garments, sauna, hot water immersion, massage) could be considered.

Although this guidance appears to be straightforward, effectively monitoring and analyzing individual responses necessitates appropriate methodologies, including the implementation of repeated measures and replication at the individual level. This can prove to be challenging both within the realm of sports practice and within research, particularly in the demanding environments of high-performance and elite sports where schedules are already tightly structured. Merely observing distinct responses among athletes at a given time point cannot alone provide the conceptual and statistical evidence required to establish the presence of genuine interindividual responses.[87–90] While the need for further research into the realm of individualized monitoring is evident, a handful of practical examples showcasing the monitoring of individual responses can be found in our published works.[14,16,23,30,60]

6 Availability of data and material

Supplementary materials can be found at the Open Science Framework project page https://doi.org/10.17605/OSF.IO/UZ4AF. All project related publications and outreach activities are documented in the accompanying Zotero web library: https://www.zotero.org/groups/4684535/regman/library.

7 Declaration of conflicting interests

The authors have no conflict/competing interests to declare.

8 Funding

The research project “REGman – Optimization of Training and Competition: Management of Regeneration in Elite Sports” was initiated and funded by the German Federal Institute of Sport Science. Main project funding number: IIA1-081901/12-16 and IIA1-081901/17-20. Online monitoring platform funding number: ZMVI4-071616/17 and ZMVI4-071603/22.

8.1 Conflict of interest/competing interests

The authors have no conflict/competing interests to declare.

8.2 Authors contributions

TW and CS conceived the idea for this article, wrote the first draft, and edited and revised the manuscript. MK, MP, TM, and AF reviewed the manuscript and approved the final version before submission.

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