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Original Article

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MONITORING TRAINING LOADS: THOR'S HAMMER FOR WINNING IN 3 TEAM SPORTS

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11 Abstract

12 **Introduction:** Monitoring training loads is a powerful tool to achieve victory in
13 team sports, represented by Thor's hammer metaphor. **Objective:** This
14 scientific article discusses the importance of monitoring training loads in team
15 sports for optimizing athletic performance and preventing injuries. **Methods:**
16 The article presents a review of the literature on monitoring training loads in
17 team sports, focusing on advancements in the field, including internal and
18 external load monitoring, monitoring tools, and monitoring devices. **Results:**
19 The review emphasizes the importance of implementing multifaceted athlete
20 monitoring systems to ensure that the correct training dose is given at the right
21 time, increase physical conditioning, and decrease fatigue. **Conclusion:** The
22 article concludes that a scientific approach to load monitoring is essential for
23 optimizing athletic performance and preventing injuries. Comprehensive
24 monitoring should address mechanical, physiological, psychological, social,
25 behavioral, and cognitive factors. Therefore, it is essential that coaches
26 understand the importance of monitoring training loads and include it in their
27 training programs, as a powerful weapon to increase performance in
28 competitions.

29 **Keywords:** Training loads, Collective sports, Monitoring training, Monitoring
30 tools.

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Article original

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SURVEILLANCE DES CHARGES D'ENTRAÎNEMENT : LE MARTEAU DE THOR POUR GAGNER DANS LES SPORTS D'EQUIPE

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Abstrait

36

37 **Introduction:** La surveillance des charges d'entraînement est un outil puissant
38 pour atteindre la victoire dans les sports d'équipe, représentée par la
39 métaphore du marteau de Thor. **Objectif:** L'article présente une revue de la
40 littérature sur la surveillance des charges d'entraînement dans les sports
41 d'équipe, en mettant l'accent sur les avancées dans le domaine, y compris la
42 surveillance des charges internes et externes, les outils de surveillance et les
43 dispositifs de surveillance. **Méthodes:** L'article présente une revue de la
44 littérature sur la surveillance des charges d'entraînement dans les sports
45 d'équipe, en mettant l'accent sur les avancées dans le domaine, y compris la
46 surveillance des charges internes et externes, les outils de surveillance et les
47 dispositifs de surveillance. **Résultats:** La revue met l'accent sur l'importance de
48 la mise en place de systèmes de surveillance polyvalents des athlètes pour
49 garantir que la dose d'entraînement correcte soit administrée au bon moment,
50 augmenter la condition physique et réduire la fatigue.
51 **Conclusion:** L'article conclut qu'une approche scientifique de la surveillance
52 des charges est essentielle pour optimiser les performances athlétiques et
53 prévenir les blessures. La surveillance complète devrait aborder les facteurs
54 mécaniques, physiologiques, psychologiques, sociaux, comportementaux et
55 cognitifs. Par conséquent, il est essentiel que les entraîneurs comprennent
56 l'importance de la surveillance des charges d'entraînement et l'intègrent dans
57 leurs programmes d'entraînement, en tant qu'arme puissante pour améliorer les
58 performances en compétition.

59 **Mots-clés:** Charges d'entraînement, Sports collectifs, Surveillance de
60 l'entraînement, Outils de surveillance.

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Artículo original

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MONITORIZACIÓN DE LAS CARGAS DE ENTRENAMIENTO: EL MARTILLO DE THOR PARA GANAR EN LOS DEPORTES DE EQUIPO

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Resumen

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69 **Introducción:** La monitorización de las cargas de entrenamiento es una
70 poderosa herramienta para alcanzar la victoria en los deportes de equipo,
71 representada por la metáfora del martillo de Thor. **Objetivo:** Este artículo
72 científico discute la importancia de la monitorización de las cargas de
73 entrenamiento en los deportes de equipo para optimizar el rendimiento atlético
74 y prevenir lesiones. **Métodos:** El artículo presenta una revisión de la literatura
75 sobre la monitorización de las cargas de entrenamiento en los deportes de
76 equipo, centrándose en los avances en el campo, incluyendo la monitorización

77 de las cargas internas y externas, las herramientas de monitorización y los
78 dispositivos de seguimiento. **Resultados:** La revisión enfatiza la importancia de
79 implementar sistemas de monitorización multifacéticos de los atletas para
80 garantizar que la dosis de entrenamiento correcta se administre en el momento
81 adecuado, aumentar la condición física y disminuir la fatiga. **Conclusión:** El
82 artículo concluye que un enfoque científico de la monitorización de las cargas
83 es esencial para optimizar el rendimiento atlético y prevenir lesiones. La
84 monitorización integral debe abordar factores mecánicos, fisiológicos,
85 psicológicos, sociales, conductuales y cognitivos. Por lo tanto, es esencial que
86 los entrenadores comprendan la importancia de la monitorización de las cargas
87 de entrenamiento y la incluyan en sus programas de entrenamiento, como un
88 poderoso instrumento para aumentar el rendimiento en las competiciones.
89 **Palabras clave:** Cargas de entrenamiento, Deportes colectivos, Monitorización
90 del entrenamiento, Herramientas de monitorización.
91

92 **Artigo Original**

93 **MONITORAMENTO DAS CARGAS DE TREINAMENTO: O MARTELO DE** 94 **THOR PARA A VITÓRIA NOS ESPORTES COLETIVOS**

95 **Resumo**

96 **Introdução:** O monitoramento das cargas de treinamento é uma ferramenta
97 poderosa para alcançar a vitória nos esportes coletivos, representada pela
98 metáfora do martelo de Thor. **Objetivo:** Este artigo científico discute a
99 importância do monitoramento das cargas de treinamento nos esportes
100 coletivos para otimizar o desempenho atlético e prevenir lesões. **Métodos:** O
101 artigo apresenta uma revisão da literatura sobre o monitoramento das cargas
102 de treinamento nos esportes coletivos, com foco nos avanços no campo,
103 incluindo a monitoração das cargas internas e externas, as ferramentas de
104 monitoramento e os dispositivos de monitoramento. **Resultados:** A revisão
105 enfatiza a importância de implementar sistemas multifacetados de
106 monitoramento de atletas para garantir que a dose de treinamento correta seja
107 administrada no momento adequado, aumentando a condição física e
108 diminuindo a fadiga. **Conclusão:** O artigo conclui que uma abordagem
109 científica para o monitoramento de cargas é essencial para otimizar o
110 desempenho atlético e prevenir lesões. O monitoramento abrangente deve
111 abordar fatores mecânicos, fisiológicos, psicológicos, sociais, comportamentais
112 e cognitivos. Portanto, é essencial que os treinadores compreendam a
113 importância do monitoramento das cargas de treinamento e o incluam em seus
114 programas de treinamento, como uma ferramenta poderosa para aumentar o
115 desempenho nas competições.

116 **Palavras-chave:** Cargas de treinamento, Esportes coletivos, Monitoramento de
117 treinamento, Ferramentas de monitoramento.
118

119 **Introduction**

120 Physical training in team sports is a complex process aimed at improving
121 athletes' performance through progressive exercises that promote

122 morphological and functional adaptations, resulting in improved physical
123 conditioning and sports performance by refining physical, technical, tactical, and
124 mental skills (BARBANTI; TRICOLI; UGRINOWITSCH, 2004; ISSURIN, 2010).
125 However, for this process to occur efficiently, an organized and structured
126 training plan is necessary (IMPELLIZZERI et al., 2020; ISSURIN, 2010).

127 Regular monitoring programs are essential to ensure that training
128 produces desirable results. The application of tests and evaluations allows the
129 coach to diagnose and understand the performance of athletes and make
130 decisions about changes in the training program, optimizing the performance
131 and minimizing the risk of injuries and diseases related to training
132 (BARTOLOMEI et al., 2014; BOURDON et al., 2017).

133 In addition, adjustments to training loads should occur at various times
134 during the training cycle, aiming to increase or decrease fatigue, depending on
135 the training goals. Adequate fatigue levels are fundamental for training
136 adaptations and competition team performance (PYNE; MARTIN, 2011).

137 Despite the extensive research on monitoring training loads in team
138 sports, the literature still needs a comprehensive overview of the different
139 purposes that monitoring serves. Monitoring training loads is a powerful tool to
140 achieve victory in team sports, represented by Thor's hammer metaphor.
141 Therefore, coaches must comprehend the significance of monitoring training
142 loads and incorporate them into their training programs.

143

144 **Methods**

145 In this manuscript, we conducted a literature review of advancements in
146 monitoring training loads in team sports. For this systematic review, we adapted
147 the Preferred Reporting Items for Systematic Reviews and Meta-Analyses
148 (PRISMA) guidelines (PAGE et al., 2021) to suit the specific requirements of our
149 study. This approach allowed us to maintain the robust, evidence-based
150 structure of the PRISMA guidelines while making specific adjustments to better
151 align with the objectives of our research. Adapting the PRISMA methodology
152 provided the advantage of ensuring high quality and reproducibility of study
153 results while tailoring it to our research needs.

154 Based on the analysis of the selected articles, trends and gaps in the
155 literature that need to be addressed were identified. The review included a
156 thorough search and screening of relevant articles, critically appraising their
157 methodological quality and synthesizing their results. The present study aims to
158 provide a reliable and transparent account of the current state of monitoring
159 training loads in team sports and contribute to the advancement of the field by
160 identifying gaps and limitations in the existing literature

161 To carry out this review, electronic searches were conducted on the Web
162 of Science, PubMed, and Scopus databases, searching for relevant studies
163 published in English that utilized the keywords "Training loads", and "Collective
164 sports", and "Monitoring Training", or "Internal load", or "External load", or
165 "Monitoring Tools". Data extraction was performed in a non-combined and
166 standardized manner. It is important to note that only peer-reviewed journal
167 articles were included in the analysis.

168 The research evolution was analyzed, considering journals, sports
169 modalities and contexts, competition level, gender, monitoring devices,

170 accelerometer-based variables, and technical characteristics. A growing
171 number of publications on monitoring training load were identified,
172 demonstrating an increasing interest of the scientific community in this area.
173

174 **Results and discussion:**

175 *Training loads*

176 Training load is an essential variable in athletes' preparation for competitions
177 and is generally divided into external and internal loads (IMPELLIZZERI;
178 MARCORA; COUTTS, 2019). It is a stimulus that the athlete experiences
179 before, during, or after the training process. It is considered a manipulable input
180 that can be adjusted to obtain a favorable training response (IMPELLIZZERI;
181 MARCORA; COUTTS, 2019; THORPE et al., 2017).

182 Although terms such as training load, fatigue, injury, and illness are
183 standard in exercise and sports science, more definitions and usage must be
184 consistent. Therefore, we will use the term "training load," defined as the stress
185 placed on the body by the activity performed (THORPE et al., 2017).

186 Training load comprises internal and external workloads, with internal
187 training load quantifying the physical burden experienced by the athlete and
188 external training load describing the quantification of work performed by the
189 athlete (BORRESEN; IAN LAMBERT, 2009; HALSON, 2014).

190 To monitor training load, it is necessary to quantify it consistently and
191 accurately. This should be the foundation of any athlete monitoring system. The
192 quantification of monitoring data can assist coaches and technical staff in
193 interpreting and applying an individualized workload for each athlete in
194 preparation for competition, prescribing specific loads, and predicting
195 subsequent physiological responses to the load (AKYILDIZ et al., 2022;
196 FREITAS et al., 2014).

197 The scientific literature, as referenced by authors such as Impellizzeri,
198 Marcora, Coutts, Thorpe, Borresen, Lambert, Halson, Akyildi and Freitas,
199 assumes a pivotal role in shaping the comprehension of training load and its
200 constituents. The consistent and precise quantification of training load emerges
201 as a fundamental element within any athlete monitoring system, holding the
202 potential to provide guidance to coaches and technical staff in the delineation of
203 tailored workloads and anticipation of physiological responses. The authors
204 emphasize the imperative for standardized definitions and usage of
205 terminologies, including training load, fatigue, injury, and illness, within the
206 domain of exercise and sports science, thereby accentuating the necessity for
207 lucidity in communication within the field.

208 The criteria for analyzing the scientific works on training loads include the
209 recognition of internal and external components, the importance of
210 quantification for effective monitoring, and the application of findings to
211 prescribe individualized workloads. The cited studies contribute to the
212 establishment of a comprehensive understanding of training load, presenting it
213 as a manipulable input that influences athletes' responses to training. The
214 integration of this knowledge into athlete preparation is underscored, with a
215 focus on minimizing injury risks and optimizing team performance. In essence,
216 the literature reviewed emphasizes the crucial role of training load in achieving

217 athletic success and advocates for a systematic and well-defined approach to
218 its analysis and application in sports science.

219

220

221 *Monitoring Training Load in Team Sports*

222 Monitoring training load in team sports can be more challenging than in
223 individual sports due to the diversity of training activities and the importance of
224 assessing the sport's tactical performance and cognitive load (GABBETT et al.,
225 2017; HALSON, 2014; MCGUIGAN, 2017).

226 Furthermore, implementing an effective monitoring system can take time
227 due to many athletes and the multifactorial complexity of sports performance,
228 training, and game demands (HALSON, 2014). Despite these challenges,
229 monitoring athletes' training load is crucial to achieve specific physiological
230 responses that promote adaptations associated with performance changes
231 (DREW; FINCH, 2016; HALSON, 2014; LAMBERT; BORRESEN, 2010;
232 SCHNEIDER et al., 2018).

233 Physical training promotes several physical and physiological
234 adaptations in athletes, which can increase sports performance. Nevertheless,
235 inadequate physical training can lead to low performance, while excessive
236 training can accumulate fatigue and its concomitants, impairing the athlete's
237 performance, and increasing the risk of injuries and illnesses. Therefore,
238 researchers and team sports coaches strive to determine the precise
239 relationship for the best possible "dose-response" between the effects caused
240 by training and the athlete's resources (VANRENTERGHEM et al., 2017).

241 In addition to its role in promoting adaptation and preventing injury,
242 monitoring enables retrospectively examining the relationships between training
243 load levels and athletes' performance. Adequate planning of training loads and
244 competitions can then be made to reduce the risk of injuries and non-functional
245 overload (HALSON, 2014; PYNE; MARTIN, 2011). Therefore, physiological
246 alterations, evaluation of movement patterns, and indicators of sport-specific
247 abilities are essential variables for monitoring athletes in team sports.
248 Performance in team sports competitions, including the influence of team
249 tactics, environmental conditions, team cohesion, and playing at home or away,
250 must also be evaluated (BUCHHEIT, 2014; PYNE; MARTIN, 2011; THORPE et
251 al., 2017).

252 Elite team sports athletes are exposed to high competitive loads, making
253 fatigue management critical to reducing injury and illness (BOURDON et al.,
254 2017; THORPE et al., 2017). Having a consistent and similar training structure
255 for each week during the competitive period is also critical. This can provide
256 weekly training and testing schedules to monitor loads during the week or after
257 the game, minimizing the effects of muscle fatigue (MCGUIGAN, 2017;
258 THORPE et al., 2017).

259 Thus, although dose-response relationships are a challenge in properly
260 quantifying load, volume, and training intensity, comprehensive monitoring is
261 crucial to understanding athletes' response to training and modifying training
262 and recovery strategies (GABBETT et al., 2017; THORPE et al., 2017). The

263 amount of work performed by athletes in training and games and the
264 consequent individual responses positively or negatively affect their
265 performance, leaving them more or less vulnerable to injuries. The load
266 monitoring process should, therefore, help coaches make decisions about the
267 availability of players for training and competition (BOURDON et al., 2017), with
268 the main objectives of improving performance and preventing injuries
269 (AKENHEAD; NASSIS, 2016; BOURDON et al., 2017; VANRENTERGHEM et
270 al., 2017). For this reason, and due to technological developments and
271 analytical methods, there is a large set of models for monitoring training loads
272 (GÓMEZ-CARMONA et al., 2020; VANRENTERGHEM et al., 2017).

273 In this way, planning is an essential part of the training process.
274 However, for the plans to be successful, the monitoring process should be
275 carried out satisfactorily in order to assess the interaction between the resulting
276 external loads compared to those that were planned (IMPELLIZZERI et al.,
277 2020), and to analyze the dose-response of these training loads in teams and
278 individually (WEST et al., 2021).

279 The literature converges on the pivotal role of physical training in
280 promoting various physical and physiological adaptations, acknowledging the
281 delicate balance required to prevent low performance or excessive fatigue.
282 Researchers and team sports coaches are tasked with determining the optimal
283 "dose-response" relationship between training effects and athlete resources.
284 This challenge is further compounded by the intricate interplay of factors such
285 as team tactics, environmental conditions, team cohesion, and home or away
286 games.

287 The high competitive loads faced by elite team sports athletes
288 underscore the critical importance of fatigue management in injury and illness
289 prevention. Consistency in training structure during the competitive period is
290 highlighted as a key strategy, with weekly schedules facilitating load monitoring
291 and minimizing the impact of muscle fatigue. The dose-response relationships
292 inherent in quantifying load, volume, and training intensity pose challenges,
293 emphasizing the need for comprehensive monitoring to understand athletes'
294 responses and tailor training and recovery strategies.

295 *Importance of Individualized Training Load Monitoring*

296 Athletes respond differently to the same training stimuli, making
297 individualized training load monitoring a crucial aspect of optimizing
298 performance and reducing injury risk. Monitoring workload demands for each
299 individual athlete can help identify those who are not responding to the training
300 program, preventing overtraining and injuries (BOURDON et al., 2017; GÓMEZ-
301 CARMONA et al., 2020). In addition, individual monitoring ensures that the
302 applied workload aligns with the coach's prescribed plan and the athlete's
303 internal load is consistent with what the coach intends (BRINK et al., 2010;
304 HALSON, 2014; IMPELLIZZERI et al., 2020; PAULSON et al., 2015).

305 In order to ensure optimal athletic performance and minimize the risk of
306 injuries and overtraining, it is essential to accurately quantify the workload
307 demands placed on athletes during training and competition
308 (VANRENTERGHEM et al., 2017). Individualized load monitoring can identify
309 athletes who are not responding to the training program and where there may
310 be a dissociation between external and internal loads.

311 Overall, the use of monitoring data allows for the ability to describe, plan,
312 and recursively monitor training load based on specific sport characteristics,
313 meeting the needs of athletes and coaches. Therefore, a good individualized
314 monitoring program is an essential tool for updating the quantitative description
315 of the team and properly monitoring the training load of each athlete. By doing
316 so, athletes can achieve their optimal performance while minimizing injury risk.

317 *Monitoring Training Loads for Sports Performance*

318 Effective workload management involves understanding the interrelationships
319 between training and competition and adjusting training volumes and intensities
320 to facilitate necessary adaptations and maintain players' physical fitness.
321 Irregular workload dynamics between different sports contexts can negatively
322 impact athletes' health and performance, underscoring the importance of careful
323 workload management throughout the training and competition cycles
324 (GABBETT, 2016; REINA ROMÁN et al., 2019).

325 The selection of appropriate sports tasks and effective workload planning
326 during competitive microcycles are essential factors in optimizing sports
327 performance. Careful and thoughtful planning of training sessions that align with
328 the sport's technical, tactical, and physical objectives can help optimize the
329 adaptation process and facilitate athletes' readiness for peak performance
330 (DREW; COOK; FINCH, 2016; MARTÍN-GARCÍA et al., 2018). Since, irregular
331 workload dynamics between different sports contexts can negatively impact
332 athletes' health and performance (GABBETT, 2016). This way, prevention
333 strategies should be implemented in conjunction with workload management
334 strategies to optimize athlete health and performance (FINCH; KEMP;
335 CLAPPERTON, 2015).

336 To optimize athletic performance and minimize the risk of injuries, it is
337 essential to understand the physical and physiological stresses that athletes
338 experience during both training and competition. This understanding is critical in
339 designing practical training sessions that align with the sport's technical, tactical,
340 and physical objectives and upcoming competitions, particularly during
341 competitive microcycles. In this way, coaches can anticipate peak performance
342 in competition by carefully designing training sessions that align with specific
343 performance goals and adjusting training volumes and intensities based on an
344 athlete's needs and characteristics (AKUBAT; BARRETT; ABT, 2014;
345 CUMMINS et al., 2013).

346 Furthermore, to ensure training effectiveness, monitoring the athlete
347 throughout all training phases is essential. By systematically monitoring athletes
348 during training sessions, coaches and trainers can gather valuable data on
349 athletes' physical and physiological responses to different training loads and
350 adjust training programs to optimize performance and minimize the risk of
351 injuries. Recent research has emphasized the importance of comprehensive
352 monitoring strategies, including wearable technologies and other advanced
353 monitoring tools (JOHNSTON et al., 2021).

354 For this purpose, the combined monitoring of internal responses with the
355 external demands of workload is essential. This is possible through different
356 variables based on tracking systems or accelerometry, which allow for objective
357 monitoring of workload (AKUBAT; BARRETT; ABT, 2014; CUMMINS et al.,
358 2013). The selection of appropriate workload indices is crucial for their control
359 and a clear presentation of the results for better decision-making by the team's

360 staff (ROJAS-VALVERDE et al., 2019). In summary, monitoring training loads is
361 fundamental for the success of sports performance, ensuring that athletes are
362 adequately prepared.

363 The reviewed literature emphasizes the importance of monitoring training
364 loads but underscores the need for more personalized approaches, taking into
365 account individual variability and the specific demands of different sports.
366 Additionally, the integration of psychological factors into training load
367 management deserves more in-depth attention. It is recommended that future
368 research explores these gaps to provide more comprehensive and applicable
369 insights for sports training professionals.

370 *Internal and External Training Loads Monitoring.*

371 In team sports, group training is frequent and essential for improving athletes'
372 technical and tactical skills. However, although athletes are subjected to similar
373 external loads, the internal load can vary according to each athlete's
374 characteristics. Training External Loads (TEL) refer to the work done by athletes
375 during planned activities by the coaching staff (BOURDON et al., 2017;
376 IMPELLIZZERI; MARCORA; COUTTS, 2019). Although these variables are
377 easily measurable, they cannot reflect the real training stress since, within a
378 team, athletes can perceive and assimilate the same TEL differently according
379 to their individual characteristics (BUCHHEIT et al., 2018).

380 On the other hand, Training Internal Loads (TIL) is the physiological and
381 psychological response of the body to the stress imposed by training, influenced
382 by factors such as physical conditioning and genetic potential. Accurately
383 monitoring this variable is crucial for the success of applied training.
384 Additionally, it is necessary to know the internal load of each athlete to distribute
385 it appropriately and avoid unwanted adaptations (HALSON, 2014;
386 IMPELLIZZERI; MARCORA; COUTTS, 2019).

387 The external load has been the basis of most monitoring systems, but the
388 internal load is fundamental in determining the training load and subsequent
389 adaptation. TIL can be measured through heart rate, training impulses
390 (TRIMPs), and the session's subjective perceived exertion (PSE). On the other
391 hand, TEL is easily measurable through distance covered, speed, and the
392 number of sprints or jumps, among others (BOURDON et al., 2017;
393 IMPELLIZZERI; MARCORA; COUTTS, 2019). Therefore, monitoring internal
394 and external load in team sports should be performed jointly, allowing for a
395 more effective and personalized training prescription, ensuring the success of
396 applied training and avoiding unwanted adaptations.

397 The identified gap in the literature revolves around the necessity to delve
398 into the complexity of TIL, encompassing physiological and psychological
399 responses influenced by factors such as physical conditioning and genetic
400 potential. While external loads form the foundation of most monitoring systems,
401 the internal load is posited as fundamental in determining training load and
402 subsequent adaptation. The cited works advocate for a more holistic approach,
403 emphasizing that TIL, measured through heart rate, training impulses, and
404 subjective perceived exertion, must be considered in conjunction with TEL
405 metrics.

406 The conclusion drawn from this analysis is that the existing literature
407 leans heavily on external load metrics, potentially neglecting the nuanced
408 internal responses crucial for effective training prescription. Future research

409 should focus on refining monitoring systems to integrate both internal and
410 external load assessments in team sports. This would lead to more
411 personalized and effective training strategies, mitigating the risk of unwanted
412 adaptations and ensuring the success of applied training. The emphasis on joint
413 monitoring of internal and external loads emerges as a pivotal step in advancing
414 the understanding and application of training loads in team sports.

415 **Conclusion**

416 While there is still a lack of studies on team sports athletes, especially
417 regarding the effects of different types of load on performance and injury
418 prevention, this review provides some practical recommendations for coaches
419 and practitioners who work with this population. Ensuring that the methods used
420 are reliable, valid, and sensitive enough to measure and impact performance is
421 essential. In addition, comprehensive monitoring must address mechanical,
422 physiological, psychological, social, behavioural, and cognitive factors to
423 optimize performance and prevent injury. Thus, sports professionals must adopt
424 a scientific approach to load monitoring and use objective and subjective
425 indicators, integrating complementary approaches in training monitoring with
426 evidence-based training effects to optimize the performance of team sports
427 athletes. Future research should focus on developing more specific and
428 individualized load monitoring tools for team sports athletes and investigating
429 the optimal balance between training load and recovery strategies.

430

431 *Conflict of Interest Statement*

432 No conflicts of interest exist in relation to the present study

433

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