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The Effectiveness of the Acute Chronic Workload Ratio Method in Monitoring the Training Load and Its Relationship with Sports Injuries: A Literature Review

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ABSTRACT

Training load monitoring is an essential aspect of modern sports to optimize performance while minimizing the risk of injury. However, there is still a lack of consensus regarding the most effective method to measure and interpret training load variations. The Acute Chronic Workload Ratio (ACWR) method has emerged as a widely discussed model, yet research evaluating its true effectiveness remains limited and fragmented. This study aims to assess the effectiveness of the ACWR method in monitoring training load and its relationship with sports injuries through a systematic literature review. Methods: A total of 205 articles published between 2020 and 2025 were initially identified from PubMed and Sage databases using specific keywords, with 7 studies ultimately meeting the inclusion criteria. These studies were analyzed using the JBI critical appraisal tool. The findings suggest a strong correlation between ACWR and injury prevention, with several studies indicating that rapid increases in training load, as reflected by high ACWR scores, significantly elevate the risk of injury. Conversely, optimal ACWR ranges can support performance improvements while minimizing harm. Although ACWR is not flawless, it is a valuable tool for intelligently managing training loads. Implications and Recommendation: The implications of this study reinforce the importance of using data-driven strategies in athlete training programs. Future research is recommended to further refine ACWR thresholds across different sports and populations, and to explore its integration with other monitoring tools for more comprehensive load management.

Keywords: ACWR; Training load; Injury risk; Athlete performance; Load monitoring

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INTRODUCTION

In the world of sports, athletes are required to always perform at their best. To ensure their performance continues to improve, training becomes an essential part that must be carried out regularly. However, excessive training can lead to injury, while training that is too light will not yield optimal results. Therefore, it is very important to know how much training is sufficient and when the body needs rest.

One of the methods currently used to help monitor training load is the Acute Chronic Workload Ratio method, abbreviated as ACWR. This method helps coaches and athletes to know whether the training being undertaken is appropriate, too light, or even too intense. The shift in understanding of training load behavior, by considering not only the absolute value but also its variation, revisits the concept introduced by Banister et al. Based on this concept, the ratio between acute training load and chronic training load is proposed, referred to as the Acute Chronic Workload Ratio (ACWR).

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Understanding the workload-injury relationship is fundamental for coaches, sports scientists, and sports medicine doctors to optimize performance while reducing the risk of injuries that can potentially be prevented by managing load. ACWR is a modeling approach used to monitor relative changes in workload to which athletes have been exposed over time and to examine workload incidents (rapid increases or decreases) that may indicate an increased risk of injury.

Therefore, the objective of this study is to provide knowledge to athletes, coaches, and all sports personnel related to improving athletic performance regarding the importance of monitoring training load and predicting the occurrence of injuries, so that the goals of a training session, both technical and physical, can be easily achieved and avoid injury and overtraining.

METHOD

Eligibility Criteria of the Reviewed Articles

This review only includes writings related to the aspect of the effectiveness of the ACWR Method in monitoring training load. This study focuses on articles that discuss the use of the ACWR method to monitor training load. The study designs included in this review are literature studies and systematic reviews, which are the central focus of this review.

Strategy of Searching Process

The strategy of the searching process was limited only to articles available online. Online searches were conducted in the Sage and PubMed databases. The author adopted studies published between 2020–2025 to obtain novelty in the final analysis results. The keywords used to identify relevant articles were as follows: “Acute” “Chronic” “Workload” “Ratio” “Method”.

Literature Management

After collecting a number of relevant literatures from the databases, the articles were organized using Mendeley reference management, and duplicates were removed. At this stage, titles and abstracts were screened by two independent reviewers to be assessed based on the review’s inclusion criteria. The reasons for exclusion of sources that did not meet the inclusion criteria were noted and explained in the PRISMA flow diagram. This review includes studies evaluating early sports specialization in young athletes. The exclusion criteria in this review included articles that did not match the keywords, as well as those discussing injury prevention in young ages and research samples from non-athletes. Thus, research involving recreational athletes was not included in this review. Disagreements between reviewers at any stage of the selection process were resolved through discussion.

Data Extraction

The JBI critical appraisal tool was used to assess the eligibility of individual studies. JBI is an instrument resembling a questionnaire used to measure the appropriateness of an article with the methods used in the research being reviewed (Joanna Briggs Institute, 2022). In conducting data extraction, in the first stage of the identification process, the authors excluded articles discussing the effects of the ACWR Method in monitoring training load and its relationship with Sports Injuries. A total of 205 articles were identified based on titles through the Sage and PubMed databases. Articles found to be duplicates were excluded in the next stage. Then, in the screening stage, 100 articles were found presenting empirical data identified from titles and abstracts; 76 articles were excluded because the articles did not specifically discuss the effects of the ACWR Method, were not specific to athletes, and the methods used were correlational and systematic reviews. Then, in the eligibility stage, 26 articles were identified with incomplete methodological information. In the final stage, 7 original articles were included in the review. The search and inclusion process are fully reported in the final scope review and presented in the flow diagram (PRISMA-ScR) in Figure 1 below.

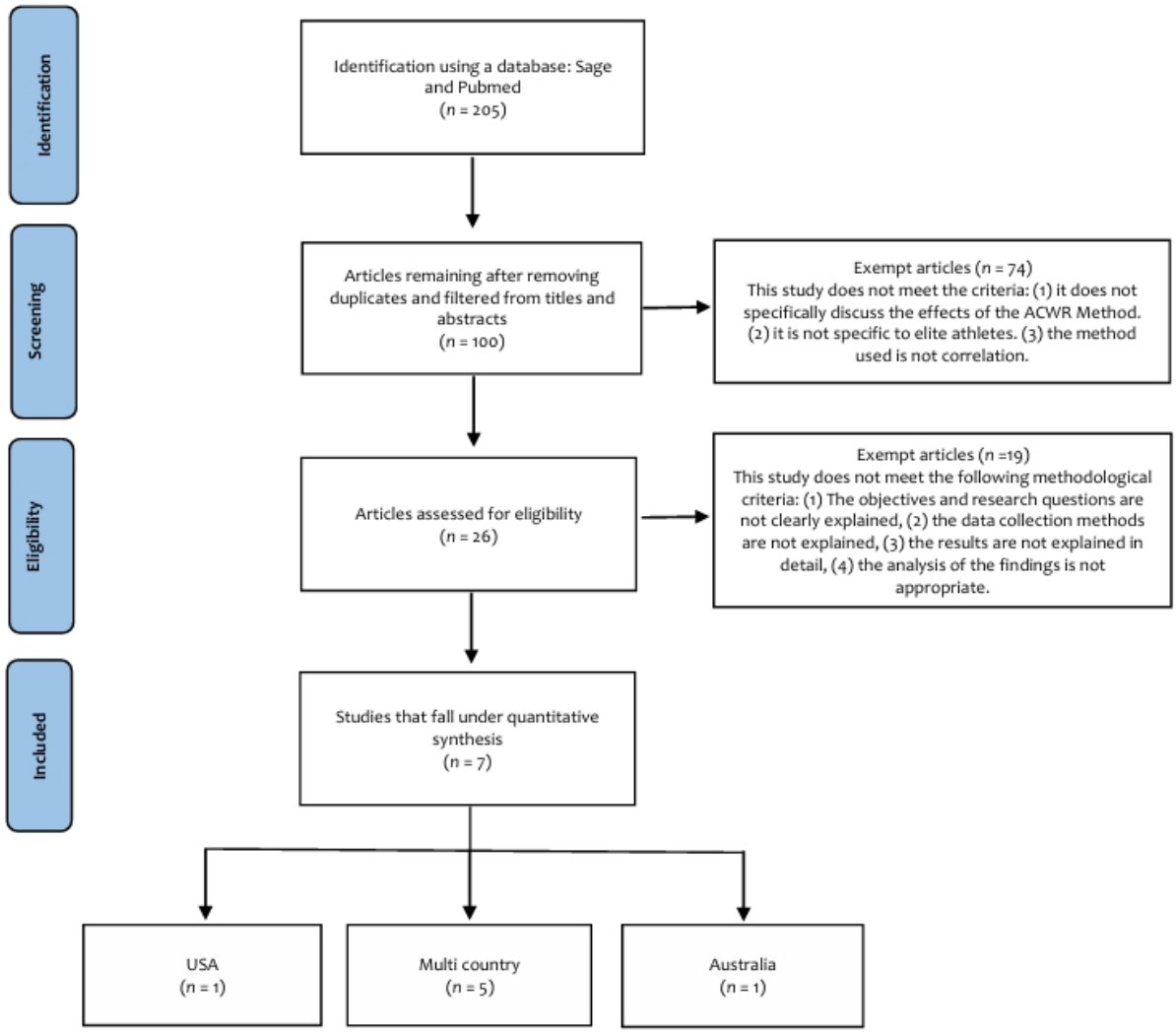

Figure 1. Prisma flow diagram

RESULTS AND DISCUSSION

Table 1. Analysis of the reviewed articles

No	Author and Year	Key Findings	Method	Objective	Location
1	(G. N. Veiga et al. 2021)	The combination of training load, ACWR, dan wellness score providing a more comprehensive picture for load management and injury prevention.	Correlational	- Explaining the values ACWR during the men's hockey season. - Determining the relationship between ACWR and subjective well-being scores (fatigue, sleep quality, muscle pain, mood, stress). - Determining the relationship between training load and well-being score.	South Africa
2	(Bowen L et al, 2020)	ACWR is very useful for identifying non-contact injury risks**.**, especially when there is a sudden spike in training load.	Correlational	- Knowing the relationship between cumulative training load (1-4 weeks). - Training load ratioAcute And Chronic. - Risk of contact and non-contact injuries	English
3	(Schumann C et al, 2023)	ACWR is effectively used to monitor training load in female adolescent volleyball athletes.	Correlational	- Evaluating the suitability between ACWR calculation methods - Compare the weekly change of load external (kinetic energy/KE) in female adolescent volleyball athletes during the high school (HSVB) and club (CVB) volleyball seasons**.**	deer
4	(Xiangyu R et al, 2024)	- All three ACWR models are practically equivalent**,** allows flexibility for coaches. - Coaches are advised to choose ACWR method according to context	Correlational	- Quantifying and comparing pre-season workload by playing position in rugby players professional. - Comparing three ACWR calculation methods	French

		and training monitoring needs.			
5	(Danny M et al, 2020)	ACWR is a useful tool in monitoring training load and managing injury risk., especially when used in conjunction with internal and external load measurements.	Systematic Review	- Quantifying Systematically reviewing the literature examining the relationship between acute:chronic training load ratio (ACWR) and injury risk in sport. - Determine which ACWR ratio is least associated with injury.	Australia
6	(Ricardo L et al, 2022)	- Variation in ACWR between weeks indicates potential increased risk if not controlled. - There is a moderate relationship between: ACWR, TM, TS, s-RPE, and the number of jumps.	Correlational	- Analyze the weekly relationship between ACWR, training monotony (TM), training strain (TS), s-RPE, and the number of jumps. - Exploring the relationship between internal and external intensity measures across a 10-week competitive season.	Portugal
7	(Renato A et al, 2020)	ACWR is a tool which is useful but must be applied with caution, because the results are highly dependent on the definition, calculation method, and context of use.	Systematic Review	- To investigate whether the acute:chronic load ratio (ACWR) related to the risk of injury *time-loss* in adult professional team athletes. - Reviews ACWR calculation methods, types of training loads, and analysis methodologies from various studies.	Switzerland

Source: personal data

Discussion

Overtraining occurs when an athlete receives too much training and too little rest. Although training is necessary to improve overall ability, without adequate recovery it can lead to fatigue, decreased performance, and even injury. Athletes often think "more is better," but the body needs time to adapt. Without sufficient recovery time, the body breaks down faster than it can rebuild, leading to what is called overtraining (Meeusen et al., 2013).

One of the biggest risks of overtraining is injury, particularly soft tissue injuries such as strains or sprains. These often result from a sudden spike in training load when an athlete quickly increases how hard, how long, or how often they train. Research shows that athletes are 5 to 7 times more likely to experience injury if their weekly training load

increases too rapidly (Bowen et al., 2020). That is why it is not just about how much you train, but how gradually you build up your training.

To avoid overtraining and injury, it is important to monitor training load, which essentially can be calculated and tracked by athletes and coaches over time. Training load can be measured in various ways, such as how far someone runs, how long they train, or how hard they feel the session was (known as s-RPE). One of the most useful tools is the Acute Chronic Workload Ratio (ACWR), which compares short-term training (such as the previous week) with long-term training (the last 3–4 weeks). If that ratio is too high, it means the athlete may be pushing too hard, too fast (Gabbett, 2016).

Coaches and athletes can use this information to plan better and more effective training according to the condition of the athlete. If the data shows a risky spike in workload, they can adjust the schedule by reducing volume, increasing rest, or adding lighter sessions. This helps athletes perform better in the long term and reduces the risk of injuries that could sideline them for weeks or months. In short, monitoring training load becomes very important for athletes to avoid injuries and improve athletic performance. Tools such as ACWR, combined with communication between coaches, medical staff, and athletes, can create a safer and more effective training environment. After all, the goal is not just to train more, but to train correctly.

CONCLUSION

Based on the results of the literature review regarding the effectiveness of the acute chronic workload ratio method in monitoring training load and its relationship with sports injuries, it can be concluded that ACWR is an important tool in modern sports to manage training load intelligently. Although not a perfect system, ACWR has proven capable of reducing injury risk and supporting optimal performance if used consistently and supported by communication between coaches, athletes, and medical teams. This study emphasizes that a data-driven approach is essential in training decision-making so that the implemented programs do not endanger the athlete instead.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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