

Periodization for Performance in Elite Athletes: From Training Planning to Competition Outcomes - A Systematic Review

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ADMINISTRATIVE INFORMATION**Support** - No specific funding was received for this review.**Review Stage at time of this submission** - Risk of bias assessment.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY2026100111**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 October 2026 and was last updated on 26 October 2026.**INTRODUCTION**

Review question / Objective Review Question What periodization strategies are used in highly trained, elite, and world-class athletes (Tier 3–5), how are training load variables, including volume and intensity, planned, structured, and sequenced over time, and how are competition outcomes reported?

Objective

The objective of this systematic review was to synthesise existing evidence on periodization strategies used in highly trained, elite, and world-class athletes (Tier 3–5), focusing on how training load was planned, structured, and sequenced over time. Specifically, the review examined how training volume and intensity were manipulated within macro-, meso-, and microcycle structures across preparatory, competitive, and transition phases. Furthermore, it investigated the monitoring strategies used to quantify training load and athlete responses, how this information informed

subsequent training adjustments, and how periodization practices were reported in conjunction with competition outcomes. The review aimed to identify key principles and limitations in the planning, monitoring, implementation, and evaluation of periodized training in high-performance sport.

Sub-questions

What periodization strategies and training structures are reported in highly trained, elite, and world-class athletes (Tier 3–5)?

How are training volume, intensity, and recovery organised and manipulated across different training phases, and what rationale is reported for these decisions?

What monitoring strategies are used to quantify training load and athlete responses throughout the training process?

How is monitoring information or athlete feedback used to inform adaptations to training plans over time?

What competition outcomes are reported, and how are they evaluated in relation to the preceding periodized training process?

What evidence is available from female athletes, and how are their periodization and monitoring practices described?

Framework for Questions (PI(E)COS)

Population (P):

Highly trained (Tier 3), elite (Tier 4), and world-class (Tier 5) athletes, as classified according to McKay et al., from individual and team sports, including both male and female athletes.

Intervention (I):

Structured periodized training programmes involving planned organisation and manipulation of training load across identifiable training phases, aimed at preparing athletes for competitive performance.

Exposure (E):

Training load variables, including training volume and intensity, their distribution and manipulation over time, and associated monitoring and athlete-response measures where reported.

Comparison (C):

No comparison or comparison between different periodization models, training strategies, training phases, competitive periods, or seasons, where available. A direct comparison between periodization strategies was not required for inclusion.

Outcomes (O):

The primary outcomes were sport-specific competition outcomes, including race times, competition results, placings, rankings, or other defined measures of competitive performance.

Study Design (S):

Original peer-reviewed research published in English, including case studies, case series, experimental, and quasi-experimental studies. Studies were eligible if they involved Tier 3–5 athletes, monitored at least 12 weeks of structured training exceeding 150 minutes per week, described training volume and intensity with identifiable variation across training phases, included a post-peak, tapering, or recovery period, and reported a defined sport-specific competition outcome. Individual-level training and competition outcomes were required for individual sports, whereas team-level data were accepted for team sports when training and performance were planned and evaluated at the team level.

Rationale Periodization represents a key, yet complex, component of training prescription in high-performance sport, involving the structured organisation of training to manage stress, promote adaptation, and optimise performance at targeted competition periods. Although a substantial body of literature has examined its theoretical foundations and different periodization models, limited evidence is available on how these principles are implemented in high-performance athletes across extended training periods and competitive seasons.

Existing research presents several methodological limitations. Many studies examine relatively short training interventions, typically lasting 8–12 weeks, which are insufficient to capture the organisation and manipulation of training load across successive phases and competitive periods. Furthermore, much of the available research involves developmental or lower-level athletes, while descriptions of training volume, intensity, progression, and recovery strategies are often insufficient to fully characterise the training process. These limitations constrain the applicability of findings to high-performance sport environments.

Another important challenge concerns the relationship between periodization strategies and competition performance. Although competitive performance represents a central objective of training planning, reported outcomes are not always adequately evaluated in relation to the preceding training process. Furthermore, limited information is available on how training load and athlete responses are monitored and used to inform subsequent adjustments to training plans. The influence of technical, tactical, and contextual factors further complicates the interpretation of performance outcomes and the evaluation of different periodization strategies.

Therefore, there is a need to systematically synthesise the available evidence in highly trained, elite, and world-class athletes (Tier 3–5), examining how training load is planned, structured, monitored, and adjusted across different training phases and competitive periods. By investigating these practices in relation to reported competition outcomes, this review aimed to identify key principles, methodological limitations, and gaps in the evidence to inform training planning and management in high-performance sport.

Condition being studied Periodization and training load management in highly trained, elite, and world-class athletes (Tier 3–5). Periodization

refers to the structured organisation of training into identifiable phases and cycles, involving planned variations in training volume and intensity to manage fatigue, promote adaptation, and optimise performance at targeted competitions. Training load management encompasses the planning, manipulation, and monitoring of training load over time, including the assessment of athlete responses and subsequent adjustments to training programmes. This review examines how these practices are implemented across training phases and competitive seasons and how they relate to reported competition outcomes.

METHODS

Search strategy MEDLINE, SPORTDiscus, and Web of Science were searched from database inception until July 2026. The search strategy was developed in conjunction with an academic librarian and adapted to each database. Medical Subject Heading (MeSH) variations and search terms related to “periodization,” “training load,” “exercise prescription,” “intensity distribution,” “load management,” “training plan,” “volume distribution,” “elite,” “high performance,” “highly trained,” “world class,” “international level,” “professional,” and “Olympic” were included. A supplementary search was conducted using Google Scholar via the Publish or Perish software, using the terms “training,” “periodization,” “elite,” and “athletes.” Results were limited to the first 1,000 records. In addition, reference lists of included studies and relevant reviews were manually searched.

Participant or population Highly trained, Elite and world class athletes across Olympic, semi-professional and professional sports, including both male and female athletes.

Intervention Structured periodized training programmes implemented in highly trained, elite, and world-class athletes (Tier 3–5) were examined. These programmes involved the planned organisation and manipulation of training load variables, particularly volume and intensity, across identifiable training phases and cycles. Periodization strategies included established models, such as traditional, block, or reverse periodization, as well as sport-specific approaches without a formally defined model. Where reported, training was organised into macro-, meso-, and microcycle structures across preparatory, competitive, and transition periods, incorporating planned variations in training load and periods of tapering or recovery intended to manage fatigue,

promote adaptation, and optimise competitive performance.

Comparator Where applicable, comparisons were made between different periodization models or training strategies (e.g., traditional, block, or reverse periodization), as well as between training phases, competitive periods, or consecutive seasons. Differences across sports and study contexts were also explored through narrative synthesis. Studies without a direct comparator, including case studies and case series describing individual periodized training programmes, were also included.

Study designs to be included Case studies, case series, experimental, and quasi-experimental studies were included. Studies with and without direct comparisons between periodization strategies were eligible. published in a peer- review journal; experimental, observational, quasi-experimental.

Eligibility criteria Studies were included when they: (1) were published in English in a peer-reviewed journal; (2) involved highly trained (Tier 3), elite (Tier 4), or world-class (Tier 5) athletes according to the classification proposed by McKay et al.; (3) used a case study, case series, experimental, or quasi-experimental design; (4) monitored a training period lasting at least 12 weeks; (5) provided evidence of structured training exceeding 150 minutes per week; (6) described training volume and intensity with identifiable variation across different training phases; (7) included a post-peak, tapering, or recovery period to allow evaluation of planned fatigue management; and (8) reported a defined competition outcome relevant to the sport context (e.g., competition, race, match, or competitive season). For individual sports, training-periodization data and competition outcomes were required at the individual-athlete level, whereas team-level data were accepted for team sports when training programmes and outcomes were planned and evaluated at the team level.

Studies were excluded if they: (1) were not published in English; (2) focused on recreational or sub-elite athletes (below Tier 3); (3) combined different age groups, competitive levels, or sexes without reporting separate results; (4) were review articles; (5) did not adequately describe training volume and intensity or identifiable training phases; or (6) did not report a defined competition outcome.

Information sources Electronic searches were conducted in MEDLINE, SPORTDiscus, and Web of Science from database inception until July 2026. A supplementary search was conducted using Google Scholar via the Publish or Perish software. In addition, reference lists of included studies and relevant reviews were manually searched to identify additional eligible studies.

Only original research studies published in English in peer-reviewed journals were eligible for inclusion. Reviews, editorials, commentaries, conference abstracts, and non-peer-reviewed grey literature were excluded.

Main outcome(s) The primary outcomes of this review were sport-specific competition outcomes reported in relation to structured periodized training programmes in highly trained, elite, and world-class athletes (Tier 3–5). These included race or event performance, competition placings, rankings, qualification status, medal outcomes, season-best performances, world-record performances, and other defined measures of competitive performance.

To examine these outcomes in relation to the preceding training process, periodization strategies and their organisational characteristics were extracted and analysed. These included study duration, identifiable training phases, macrocycle, mesocycle and microcycle structures, and the manipulation of training volume and intensity over time. Where reported, additional characteristics included training intensity distribution, weekly training volume, session frequency, sport-specific training content, and the organisation of tapering, recovery, and transition periods.

Competition outcomes were examined in relation to the training periods and competitive objectives described in each study. Where available, changes in performance across competitions, training phases, or consecutive seasons were considered, alongside comparisons between periodization strategies. The review also examined how competition outcomes were evaluated in relation to previous performance, expected competitive objectives, and the training implemented, to determine the extent to which the available evidence supported an evaluation of the reported periodization strategies.

Additional outcome(s) Additional outcomes included the monitoring methods used to quantify training load and evaluate athlete responses throughout the periodized training process, as well

as reported adjustments to training informed by monitoring information or athlete feedback. Training-load monitoring methods included session rating of perceived exertion (sRPE), heart rate, training intensity zones, power output, speed, distance, GPS-derived variables, sport-specific workload measures, and derived training-load indices where reported.

Athlete-response monitoring included physiological, neuromuscular, biochemical, and subjective measures, where available. These included repeated physiological testing, blood lactate responses, strength or neuromuscular performance measures, resting heart rate, body mass, perceived fatigue, recovery status, muscle soreness, sleep quality, wellness, and readiness. Information was also extracted on whether and how monitoring data or athlete feedback informed subsequent modifications to training volume, intensity, duration, or recovery strategies. These additional outcomes were examined to characterise how periodized training programmes were monitored, adjusted, and evaluated over time. They were used to contextualise the reported competition outcomes rather than as independent indicators of the effectiveness of a particular periodization strategy.

Data management Records identified through electronic database searches and supplementary sources were imported into Covidence, where duplicate records were identified and removed. Covidence was used to manage title and abstract screening and full-text eligibility assessment, conducted independently by two reviewers. Disagreements were resolved through discussion, with arbitration by a third reviewer where required.

Data from included studies were extracted and organised using a pre-designed Microsoft Excel spreadsheet. The spreadsheet was used to systematically record study and athlete characteristics, periodization strategies, training-load organisation, monitoring methods, and competition outcomes. Data extraction was performed by one reviewer and cross-checked by a second reviewer.

The study selection process was documented using a PRISMA 2020 flow diagram.

Quality assessment / Risk of bias analysis Methodological quality was assessed using a modified seven-item checklist adapted from Moola et al., Munn et al., and Murad et al., designed to accommodate the case studies and case series included in this review. Each item was scored as

yes (1 point), unclear (0.5 points), or no (0 points), providing a maximum possible score of 7 points per study.

The checklist evaluated whether athlete characteristics were clearly described, training programmes and training-load monitoring methods were adequately reported, and competition outcomes were sufficiently documented. Additional criteria assessed whether alternative factors potentially influencing the observed outcomes were considered, whether the follow-up duration was sufficient, and whether the studies provided sufficient detail to allow replication or inform practical applications.

Two reviewers (D.M. and M.M.) independently assessed all included studies. Disagreements were resolved through discussion, with involvement of a third reviewer (D.P.) where required. The total score was used to provide an overall indication of methodological quality and to support the interpretation of the available evidence. No studies were excluded based on methodological quality.

Strategy of data synthesis Data were synthesised using a structured narrative synthesis informed by the framework proposed by Popay et al. (2006). A meta-analysis was not performed due to heterogeneity across studies in sports, athlete populations, study designs, training structures, monitoring methods, and competition outcomes.

Extracted data were first tabulated and summarised descriptively to characterise study designs, athlete populations, training duration, periodization strategies, training phase structures, training-load organisation, monitoring methods, and reported competition outcomes.

The synthesis examined how periodized training was structured and implemented across different sporting and competitive contexts. Studies were compared according to their reported periodization approaches, including traditional, block, reverse, and other sport-specific training structures, where applicable. Comparisons also considered the organisation of training across macro-, meso-, and microcycles, the manipulation of training volume and intensity across different phases, and the integration of tapering and recovery strategies.

Training-load and athlete-response monitoring methods were examined to identify how training was quantified and evaluated, and whether monitoring information or athlete feedback was used to inform subsequent training adjustments.

Reported competition outcomes were examined in relation to the preceding training process, including differences in outcome measures, longitudinal performance reporting, and comparisons between training strategies or competitive periods where available. Particular attention was given to whether competition outcomes were evaluated in relation to previous performance, competitive objectives, and the training implemented.

Relationships and differences across studies were explored through structured comparisons of periodization practices, training-load organisation, monitoring approaches, and competition outcomes. The robustness of the synthesis was assessed by considering methodological quality, reporting completeness, and study limitations that constrained interpretation and comparison across studies. The synthesis aimed to identify common principles, differences, and limitations in the available evidence rather than establish causal relationships or develop a new explanatory theory.

Subgroup analysis Formal statistical subgroup analysis is not planned because a meta-analysis will not be conducted. Where sufficient data are available, narrative subgroup comparisons will be explored to identify whether periodization strategies and their evaluation differ across relevant study characteristics.

Potential subgroups will include sport type, individual versus team sports, athlete calibre, sex, study design, duration of the training period, type of periodization strategy, type of competition outcome, and type of monitoring method used. Periodization strategies may be compared across traditional, block, polarized, pyramidal, hybrid, taper-focused, or competition-oriented approaches.

Monitoring-related comparisons will consider whether studies used training-load monitoring, response-to-training monitoring, physiological or sport-specific performance testing, or a combined monitoring approach. Training-load monitoring may include training diaries, session rating of perceived exertion, heart rate, power output, speed, distance, GPS-derived variables, training intensity zones, or sport-specific workload measures. Response-to-training monitoring may include wellness, fatigue, recovery, perceived exertion, neuromuscular, physiological, or sport-specific performance measures.

Outcome-based comparisons may consider whether success was evaluated through race or event performance, match or season outcomes, rankings, medals, personal bests, season-best performances, world-record performances, or

return to world-class level. These subgroup comparisons will be descriptive and used to support the critical narrative synthesis, rather than to estimate pooled effect.

Sensitivity analysis No formal statistical subgroup analyses were conducted, as no meta-analysis was performed. Instead, descriptive comparisons across studies were incorporated into the structured narrative synthesis to explore differences in periodization practices, training-load organisation, monitoring strategies, and reported competition outcomes.

Comparisons considered different sporting and competitive contexts, including the periodization approaches reported (e.g., traditional, block, and reverse periodization), the organisation of training phases, and the manipulation of training volume and intensity over time. Differences in training intensity distribution, tapering, and recovery strategies were also examined where sufficient information was available.

Monitoring-related comparisons explored the methods used to quantify training load and athlete responses, as well as whether monitoring information or athlete feedback informed subsequent training adjustments. Competition outcomes were examined according to the performance measures reported and whether performance was evaluated longitudinally, compared across training periods or seasons, or documented as an individual competitive endpoint.

These comparisons were descriptive and contributed to the narrative synthesis rather than representing formal subgroup analyses. Differences in study characteristics, methodological quality, and reporting completeness were considered when interpreting the findings.

Language restriction Only English study have been considered.

Country(ies) involved Only studies published in English have been included.

Other relevant information This systematic review is being registered retrospectively, following completion of the literature search, study selection, data extraction, and methodological quality assessment. The registration documents the methodological procedures applied during the review rather than a prospectively registered protocol. At the time of registration, the manuscript was undergoing co-author review and refinement.

Keywords Periodization; Training Load Management; Elite Athletes; Training Planning; Athlete Monitoring; Tapering; Competition Performance.

Dissemination plans The findings of this systematic review will be disseminated through publication in an international peer-reviewed scientific journal. The results are expected to contribute to the understanding of periodization and training load management in high-performance sport, providing relevant insights for researchers, coaches, and sport science practitioners. Additional dissemination through scientific conferences and professional presentations may be considered to support the translation of findings into applied high-performance sport settings.

Contributions of each author

Author 1 - Davide Mondin - is the first author and led the conceptualisation and design of the systematic review, development of the methodology, and coordination of the research process. Contributed to literature screening and methodological quality assessment, conducted data extraction, and led the narrative synthesis, interpretation of findings, manuscript writing, and subsequent revisions..

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Author 2 - David Pyne - Played a key role in the scientific and methodological refinement of the review, serving as the third reviewer to resolve disagreements regarding screening, eligibility, and methodological assessment where required. He contributed substantially to the interpretation of findings, as well as to the writing, development, and critical revision of the Results.

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Author 3 - Aaron Coutts - Contributed to the conceptualisation and design of the review, providing subject-matter expertise in periodization and high-performance sport, and critical input into the interpretation of findings and refinement of the manuscript. Played a key role in the scientific and methodological refinement of the review, serving as the third reviewer to resolve disagreements.

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Author 4 - Alex Natera - Provided input into the review design and feedback on the manuscript, particularly regarding its practical relevance to high-performance sport. contributed to the design of the review and provided feedback on the final manuscript, particularly in relation to the applied high-performance sport context and practical interpretation of the findings.

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Author 5 - Murray Turner - Contributed to the development and refinement of the search strategy. His contribution included support with search terms, database-specific search strings, and optimisation of the systematic search process.

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Author 6 - Michelle Minehan - Played a major role in the design of the review and development of its methodology. She contributed extensively to title and abstract screening, full-text assessment, methodological quality assessment, and verification of data extraction. She also made substantial contributions to the interpretation of findings, manuscript development, writing, and critical revision.

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