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Original Research

Training Load and Recovery During a Pre-Olympic Season in Professional Rhythmic Gymnasts

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Context: Rhythmic gymnastics requires a high level of complexity and perfection of technical gestures, associated with well-developed physical and artistic capacities. The training-load and recovery profiles of rhythmic gymnasts across a season are unknown.

Objective: To analyze the training load and recovery of professional rhythmic gymnasts during 1 season.

Design: Cohort study.

Setting: Brazilian National Training Center of Rhythmic Gymnastics and competition facilities.

Patients or Other Participants: Eight gymnasts from the Brazilian national senior rhythmic gymnastics group.

Main Outcome Measure(s): Session rating of perceived exertion (session-RPE) and total quality recovery (TQR) scores were collected daily for 43 weeks. We obtained the session-RPE after each session and TQR score before the first session of the day. Performances during 5 competitions were also recorded. The season was divided into 8 periods. Total weekly internal training load (wITL), training intensity, frequency, duration, recovery, and acute : chronic workload ratio were calculated for analysis.

Results: The season mean wITL was 10 381 ± 4894 arbitrary units, mean session-RPE score was 5.0 ± 1.6, and mean TQR score was 12.8 ± 1.3. The gymnasts trained an average of 8.7 ± 2.9 sessions per week, with a mean duration of 219 ± 36 minutes. Each competitive period showed increased wITL compared with the previous period. Training-load variables (wITL and session-RPE) and recovery were inversely correlated. Gymnasts were poorly recovered (TQR $<$ 13) during 50.9% of the season (n = 167 times), especially during competitive weeks. Spikes in load (acute : chronic workload ratio $\geq$ 1.5) occurred across 18.1% of the season (n = 55 times).

Conclusions: The training-load variables and recovery changed throughout a professional rhythmic gymnastics group season, mainly during competitive periods. The correct distribution of training load is critical to ensure that gymnasts are entering competitions in a recovered state.

Key Words: monitoring, session rating of perceived exertion, total quality recovery, acute : chronic workload ratio

Key Points

- Most high weekly training loads, high-intensity training, and spikes in load occurred during competitive periods.
- Training-load variables increased during competitive periods.
- During half of the season, the gymnasts were not adequately recovered, especially during competition weeks.
- The periods of underrecovery were more frequent when associated with high-intensity training and an acute : chronic workload ratio $\geq$1.5, reinforcing the negative association between total quality recovery and internal training-load variables.
- Despite the negative relationship, high training loads alone did not cause underrecovery.

The challenge of sport training is to promote appropriate stimuli for each athlete to achieve specific adaptations and the best performance at the right moments.[1] Therefore, a balance between the stressor stimuli (load) and recovery is necessary to promote positive psychophysiological changes in athletes.[1–3] However, the relationship among load, recovery, and performance is complex, with a fine line between the achievement of training goals and the occurrence of maladaptation.[3–5] A better understanding of the relationship between the training load and consequent athlete response is possible via an individual, accurate, and longitudinal monitoring process during different periods of the season.[2]

To improve this understanding, several methods of quantifying internal and external training loads have been described.[2] Among these, the session rating of perceived exertion (session-RPE)[6] stands out as a method of monitoring internal training load (ITL) because it involves a simple, noninvasive, and low-cost application tool.

Portions of the Methods section were adapted with permission from Debien PB, Mancini M, Coimbra DR, de Freitas DGS, Miranda R, Bara Filho MG. Monitoring training load, recovery, and performance of Brazilian professional volleyball players during a season. *Int J Sports Physiol Perform*. 2018;13(9):1182–1189. Copyright 2020 Human Kinetics, Inc.

Moreover, it has been a reliable and ecologically valid method of monitoring ITL in athletes from multiple sports.[7]

Holistic monitoring of training requires an integrated analysis of several variables (eg, physiological, psychological, sociological, and mechanical) measured with different tools (eg, objective and subjective) to transform data into real-time action on the field.[2,3] Several instruments have been used to measure and monitor athletes' perceptions of recovery and wellbeing.[3,5,8] Subjective tools have greater sensitivity and responsivity to variations in external training load than do other, more objective tools.[3,8] Given its simplicity and practicality, the total quality recovery (TQR) scale[9] offers a viable method of monitoring athlete recovery.[10–13]

Rhythmic gymnastics requires a high level of complexity and perfection of technical gestures (with the body and manual apparatus), associated with well-developed physical and artistic capacities.[14] Gymnasts are subjected to high training loads from a very young age,[14–16] which can result in overuse injuries and maladaptation as a consequence of such training.[17–19] Elite gymnasts perceived that these high or inadequate training loads were the main causes of their injuries[20] and impaired sleep and performance.[21] Furthermore, researchers have recently identified relationships between injury risk and training-load distribution[4,22,23] and perceived recovery,[24] which reaffirm the importance of understanding the behavior and relationships of these variables in high-level sports, such as rhythmic gymnastics. Despite the many training-load studies that have been conducted, few investigators[16,25] have discussed the distribution of training load and responses to it in rhythmic gymnasts.

Research involving longitudinal monitoring of training in rhythmic gymnasts is lacking, reinforcing the need to better understand the training dose-response relationship in these athletes. The training-load and recovery profiles of rhythmic gymnasts across an entire season are unknown. Therefore, the purpose of our study was to analyze the training load and recovery of professional rhythmic gymnasts during 1 season.

METHODS

Participants

Eight gymnasts (age = 20.5 ± 2.5 years, height = 165 ± 4 cm, mass = 53.38 ± 3.93 kg, experience in rhythmic gymnastics = 14.3 ± 2.4 years) from the Brazilian senior rhythmic gymnastics group participated. In the last 2 decades, Brazil has developed a tradition of accomplishment in rhythmic gymnastics group exercises (5-time Pan American champions and 2-time Olympic finalists between 1999 and 2015) such that the best Brazilian gymnasts are invited to join the national group each season. The present sample of gymnasts were the Pan American champions and ranked 16th in the 2015 World Championship. They were in good health at the beginning of the study, although some had minor lower limb overuse injuries (eg, tendinopathy, fasciitis). They were familiarized with the monitoring tools. All participants provided written informed consent, and the study was approved by the Ethics Committee in Research with Humans of the Federal University of Juiz de Fora (CAAE 41423314.7.0000.5147).

Design

The group was monitored across 363 training sessions and 16 competition sessions during a 43-week period between February and December 2015. The training program was planned exclusively by the technical staff (C.F.) without interference from the researchers. Training sessions started with a light warm-up, followed by classical ballet, conditioning (strength and flexibility), and technical training (repetitions of isolated movements, parts, and the whole routine). The technical staff divided the season into 8 periods based on the model proposed by Laffranchi[26]: basic preparatory, specific preparatory, precompetitive, competitive 1, varied, competitive 2, competitive 3, and transitional (Table 1). During the monitored season, the group participated in 5 international competitions: Grand Prix Berlin Masters, Pan American Games (first main competition), World Cup, World Championship (second main competition), and Meeting Brazil.

Training Load

Duration and frequency of the training and competition sessions were captured. The ITL was determined by the session-RPE method.[6] The session ITL was calculated as the product of the duration of the training session (in minutes) and session-RPE score and reported in arbitrary units (AUs). The ITL was described using the total weekly ITL (wITL), which was the sum of all session ITLs during that week. The wITL was classified according to the range of mean values observed throughout the 43 weeks: *high* ($\geq$75%), *moderate-high* ($\geq$50% to $<$75%), *moderate-low* ($\geq$25% to $<$50%), or *low* ($<$25%).[12,27] The session-RPE score of each session (training intensity) was classified as *high* ($\geq$7), *moderate* ($>$4 to $<$7), or *low* ($\leq$4).[28,29] From the wITL values, we computed the *acute : chronic workload ratio* (ACWR). This ratio describes the acute (1-week) workload in relation to the chronic (4-week rolling average) workload.[22,23] The ACWR was calculated using coupled acute and chronic workload data.[30] A *spike*, or rapid increase, in training load was defined as an ACWR $\geq$1.5. On days off, the training load was considered zero, and this value was included in the general analysis.

Recovery

The TQR scale[9] was used to monitor recovery. Before the first session of each day, athletes answered the question, "How do you feel about your recovery?" by pointing to a value on the scale from 6 to 20. Daily TQR values from a given week were used to calculate the weekly average TQR score for each athlete. The TQR score was not assessed on days off. A score of $\geq$13 (*reasonable recovery*) indicated a minimally adequate recovery state.[9]

Performance

Performance was assessed via competition scores[25] and rankings[21] obtained over the season. The gymnasts presented 2 routines in each competition (mix: 6 clubs and 2 hoops; simple: 5 ribbons). The judges evaluated each routine independently, and the maximal possible score was 20 points.

Table 1. Description of Season Periods of Professional Rhythmic Gymnasts

Period	Weeks	Characteristics
Basic preparatory	1–4	General conditioning, mainly flexibility, aerobic capacity, and strength; promotion of new morphologic adaptations in the athlete's body after vacation and the composition of new routines
Specific preparatory	5–9	Development of main physical capacities in a specific way (flexibility and explosive strength); decrease in duration of general conditioning and greater duration and intensity of specific conditioning; increase in technical training duration and intensity
Precompetitive	10–18	Improvement of the competitive performance, increasing the specificity in all components of the training session; shorter training sessions with high intensity and quality, focusing on technical training; decrease in conditioning duration
Competitive 1	19–22	Peak performance during the first main competition of the season; focus on technique and routine, with high intensity and decrease in errors during the repetitions with and without music; increase in presentations and simulations of competition, with audience; adjustment of training plan in accordance with the competition (eg, time zone, frequency, duration)
Varied	23–27	Recovery and maintenance of peak performance reached in the previous period; new period of preparation and conditioning, with lower duration and high specificity; intense technical-tactical training to correct mistakes observed during competitions; small changes in routine if necessary
Competitive 2	28–30	Peak performance during the second main competition of the season; adjustment of training loads, focusing on technical training and routine repetition
Competitive 3	31–40	Recovery and maintenance of peak performance reached in the previous period; adjustment of training loads, focusing on technical training and routine repetition
Transitional	41–43	Active recovery; great change in the usual training schedule; decrease in training load, with low intensity; focus on ballet and technique of apparatus, without great physical demand; possible creation of new routines for the next season

Statistical Analysis

The weekly descriptive analysis of training-load variables and recovery was reported throughout the season. To test differences among the wITL, session-RPE, training duration, recovery, and ACWR of the season periods, we used generalized estimating equations with a γ distribution. When differences were present, we compared the means of each period (except for the last) with the mean of the subsequent periods using the post hoc Bonferroni test. Effect sizes were calculated using Cohen *d*, adopting the following classification for data interpretation: *trivial* (<0.2), *small* (0.2–0.6), *moderate* (0.6–1.2), *large* (1.2–2.0), or *very large* (2.0–4.0).[31] Pearson product moment correlation coefficients and corresponding 90% confidence intervals (CIs) were used to analyze the relationships between the ITL variables and TQR score over the season. The magnitude of correlations was determined using the modified scale of Hopkins[31]: *trivial* ($r < 0.1$), *small* ($r = 0.1$–0.3), *moderate* ($r = 0.3$–0.5), *large* ($r = 0.5$–0.7), *very large* ($r = 0.7$–0.9), *nearly perfect* ($r > 0.9$), or *perfect* ($r = 1$). We also described the proportions of classifications of weekly wITL, training intensity, recovery state, and spikes in load completed by each gymnast during the season. Data were analyzed using SPSS (version 24; IBM Corp, Armonk, NY). The α level was set at .05.

RESULTS

The distributions of wITL, frequency and intensity (session-RPE) of sessions, recovery, and ACWR over the season are shown in Figure 1. The wITL mean was 10 381 ± 4894 AU, and the highest value was 21 012 ± 2122 AU (week 38). The mean weekly session-RPE score was 5.0 ± 1.6, and the highest was 8.1 ± 0.4 (week 38). The average number of sessions per week was 8.7 ± 2.9. Mean session duration was 219 ± 36 minutes, and mean total weekly duration was 1878 ± 671 minutes. The mean TQR score was 12.8 ± 1.3, the lowest was 9.9 ± 2.9 (week 40), and the highest was 15.3 ± 2.8 (week 41). The mean ACWR across the season was 1.09 ± 0.52, reaching 2.69 ± 0.25 in week 34.

Training load and recovery variables during each period of the season are presented in Table 2. Sequential comparison showed mainly variations of training-load variables across the second half of the season, especially in competitive 2. For recovery scores, we observed a small reduction in the precompetitive period and a moderate increase in the transitional period. The ACWR displayed very large increases in competitive 2 and 3 and a moderate reduction in the transitional period. Performance during the 5 competitions by the judges' scores (total score of each routine in qualification and final), all-around (sum of scores of qualification) ranking position, and number of national group participants is provided in Table 3.

We noted correlations, albeit they were small to moderate, between TQR score and wITL (N = 328; $r = -0.17$; 90% CI = –0.26, –0.08; $P = .002$) and session-RPE (N = 328; $r = -0.32$; 90% CI = –0.40, –0.23; $P < .001$). No correlation existed between TQR score and duration (N = 328; $r = 0.01$; 90% CI = –0.08, 0.10; $P = .90$) and ACWR (N = 304; $r = 0.02$; 90% CI = –0.08, 0.11; $P = .80$).

Across the season, 12.8% (n = 44) of individual wITL magnitudes were classified as high, 30.2% (n = 104) as moderate-high, 43% (n = 148) as moderate-low, and 14% (n = 48) as low. Of the session-RPE classifications, 9.0% (n = 31) were high, 64.8% (n = 223) were moderate, and 26.2% (n = 90) were low intensity. The TQR score was <13 (underrecovery) in 50.9% (n = 167) of individual weekly occurrences. Across the 5 competitions (weeks 15, 22, 26, 30, and 40), the proportions of underrecovered gymnasts were 75% (n = 6), 50% (n = 4), 100% (n = 8), 75% (n = 6), and 87.5% (n = 7), respectively. Considering only the training intensity and recovery state, across 70.3% (n = 52/74) of low-intensity weeks, the gymnasts were recovered. In contrast, across 74.2% (n = 23/31) of high-intensity weeks, the athletes were in an underrecovered state. Individual spikes in load were observed 55 times (18.1%). Moreover, 80% of high wITL, 74% of high-

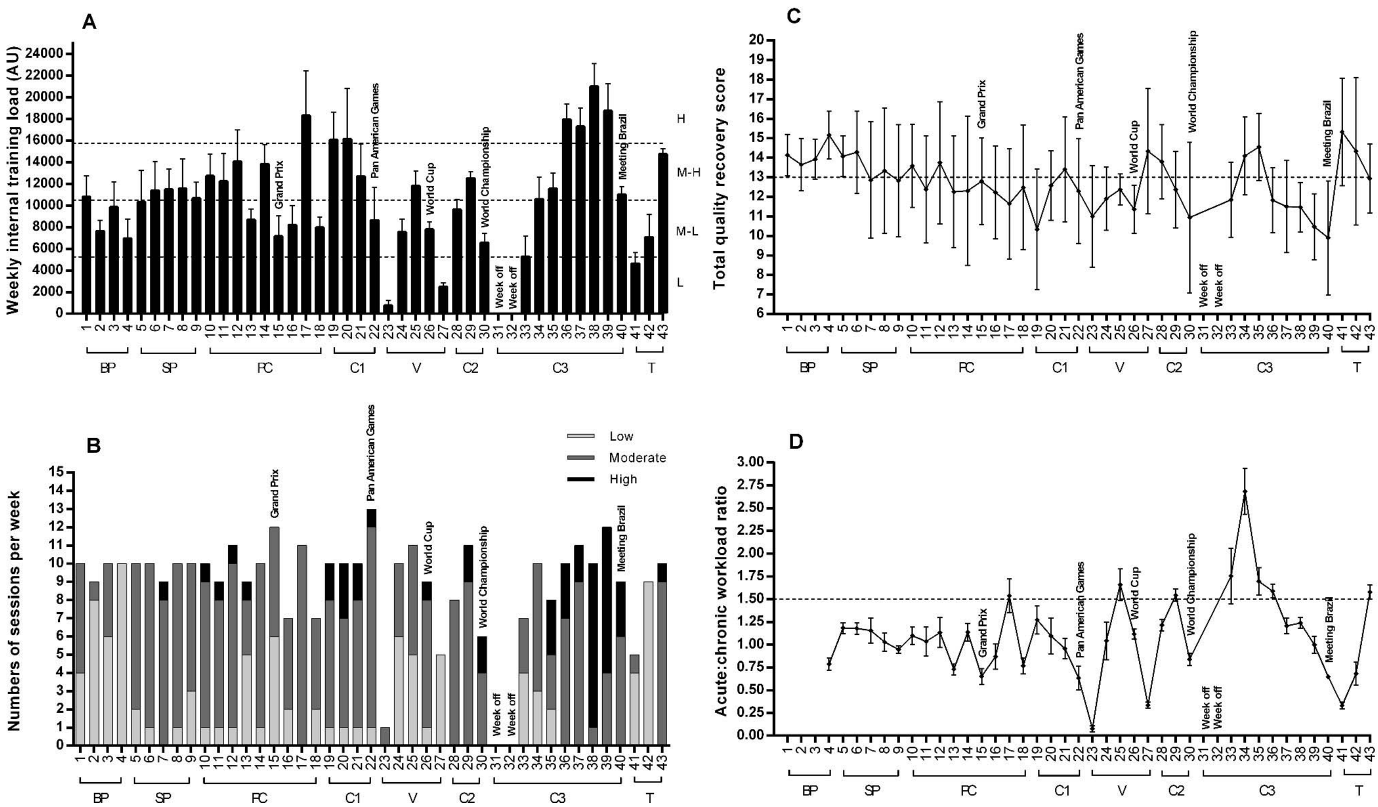

Figure 1. Distribution of A, weekly internal training load; B, number and intensity of sessions per week; C, total quality recovery score; and D, acute : chronic workload ratio throughout a season in a professional rhythmic gymnastics group.

intensity training, 41% of low-intensity training, and 67% of spikes occurred during competitive periods. The distribution and proportions of 304 individual measures of training load, spikes in load, and recovery state are illustrated in Figure 2. The proportion of gymnasts who had either a moderate-high or high training load, under-recovery state, or spikes in load during each week of the season is given in Figure 3.

DISCUSSION

We analyzed the training load and recovery of professional rhythmic gymnasts during 1 season. Training load and recovery changed across the season, particularly during competitive periods. The gymnasts were poorly recovered during half of the season, with negative correlations between recovery and training load. To ensure optimal recovery of rhythmic gymnasts preparing for international competitions, distribution of the training load may require modification.

Compared with values previously described in professional athletes,[10,12,27] the wITLs we observed in the rhythmic gymnasts were considerably higher. This was a consequence of the long duration and high frequency of training sessions per week.[15,19,20] Despite the higher absolute magnitude of wITL, the high-load weeks were less frequent across the season. Authors of similar studies of professional volleyball[12] and futsal[27] players have shown

Table 2. Weekly Internal Training Load, Session Rating of Perceived Exertion, Total Weekly Training Duration, Recovery Score, and Acute : chronic Workload Ratio of Each Period of the Season

	Weekly Internal Training Load		Session Rating of Perceived Exertion		Total Weekly Training Duration		Total Quality Recovery Score		Acute : chronic Workload Ratio	
Season Period	Mean ± SD, Arbitrary Units	Effect Size	Mean ± SD	Effect Size	Mean ± SD, min	Effect Size	Mean ± SD	Effect Size	Mean ± SD	Effect Size
Basic preparatory	8799 ± 2040	1.12	3.9 ± 0.8	1.13	2255 ± 39	0.22	14.2 ± 1.3	0.57	ND	ND
Specific preparatory	11 082 ± 3194[a]	0.12	4.8 ± 1.5[a]	0.21	2263 ± 207	1.01	13.5 ± 3.7	0.23	1.09 ± 0.08	1.25
Precompetitive	11 461 ± 2556	0.75	5.1 ± 0.9	0.58	2054 ± 257[b]	0.44	12.6 ± 6.3[b]	0.07	0.99 ± 0.08	0.00
Competitive 1	13 391 ± 3392[a]	2.16	5.7 ± 1.6	0.49	2168 ± 198	4.96	12.1 ± 2.8	0.01	0.99 ± 0.15	0.57
Varied	6073 ± 554[b]	6.31	4.8 ± 1.6[b]	0.74	1183 ± 152[b]	2.62	12.2 ± 1.3	0.13	0.87 ± 0.28	2.00
Competitive 2	9571 ± 370[a]	4.80	6.0 ± 0.2[a]	3.80	1583 ± 68[a]	1.99	12.4 ± 1.9	0.21	1.19 ± 0.04[a]	6.20
Competitive 3	11 348 ± 1931[a]	1.31	5.2 ± 0.8[b]	0.67	1718 ± 164[a]	0.51	12.0 ± 3.0	0.73	1.50 ± 0.06[a]	1.40
Transitional	8825 ± 696[b]	ND	4.6 ± 0.4[b]	ND	1801 ± 136[a]	ND	14.2 ± 2.4[a]	ND	0.87 ± 0.05[b]	ND

Abbreviation: ND, no data.

[a] Increase from the previous period ($P < .05$).

[b] Decrease from the previous period ($P < .05$).

Table 3. Scores and All-Around Rankings From the 5 Competitions During the Season

Competition	Location (City, Country)	Week	Scores: Qualification Mixed Routine[a]	Qualification Simple Routine[b]	Final Mixed Routine[a]	Final Simple Routine[b]	All-Around Ranking/ No. of Participants
Grand Prix Berlin Masters	Berlin, Germany	15	15.250	14.400	12.400	13.650	7/7
Pan American Games	Toronto, Canada	22	15.433	14.800	14.962	15.000	1/5
World Cup	Sofia, Bulgaria	26	16.200	15.000	ND	ND	13/19
World Championship	Stuttgart, Germany	30	15.900	16.041	ND	ND	16/24
Meeting Brazil	Vitoria, Brazil	40	16.550	16.100	17.250	16.100	2/3

Abbreviation: ND, no data.

[a] Six clubs and 2 hoops.

[b] Five ribbons.

frequencies of 64% and 27% high wITL during the season, respectively, contrasted with 12.8% in our study. The literature[22,23] has demonstrated that reaching high (and appropriate) chronic loads over the season is important, but the type, content, and progression of these loads are also relevant to minimize the risk of injury and optimize performance. Team sports usually present long competitive periods (months), with 1 or 2 matches per week,[4,12] which makes gradual increases in wITL across the in-season period difficult. Conversely, given the frequency and duration of competitions (2–4 days), the rhythmic gymnastics calendar may benefit from a safer wITL progression over the season. Along with what (type and content) and how (progression) high loads are achieved, it is also important to manage when they occur across the season for each athlete. In our study, 80% of high wITL, 74.2% of high-intensity training, and 67% of spikes occurred during competitive periods. This loading profile may impair gymnasts' recovery and performance during competitions, as well as expose them to maladaptation.

Corroborating our results, researchers[19,20,21] have also reported long training durations for rhythmic gymnasts. This finding may be related to the number of interventions and the feedback given by coaches during training sessions due to the highly technical demands of the sport. However, the concept of training load is not exclusively related to physical load.[4] In this respect, these moments are an inherent part of training in aesthetic sports and represent the cognitive load that would still contribute to the ITL. Despite the validity and reliability of the session-RPE method, it is possible that a more specific tool capable of measuring these nuances could provide more accurate training-load information and avoid overestimations.

In rhythmic gymnastics, greater focus on technical training and routine repetition is expected as a competition draws closer.[17,26] Law et al[19] found that technical training and routine repetition were the most demanding parts of training for elite rhythmic gymnasts. Furthermore, Fernandez-Villarino et al[25] observed session-RPE scores between 7 and 9 (high intensity) during 10 sessions in the competitive period. Our results showed an increase in session-RPE during the competitive 2 period and reduced frequency of low-intensity training in competitive periods

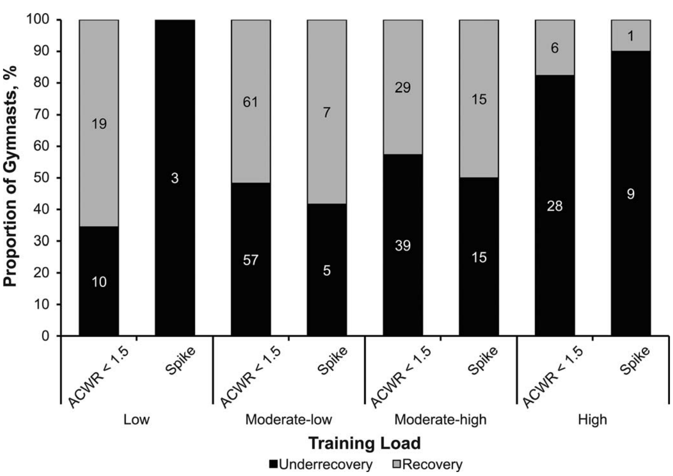

Figure 2. Number and proportion of gymnasts in >1 category of training load, underrecovery (total quality recovery score < 13) or recovery (total quality recovery score ≥ 13) state, or spikes (acute : chronic workload ratio [ACWR] ≥ 1.5) in load during each week of the season (N = 304). Low training load indicates a weekly internal training load <25%; moderate-low, 25% ≤ weekly internal training load <50%; moderate-high, 50% ≤ weekly internal training load <75%; and high, weekly internal training load ≥75%.

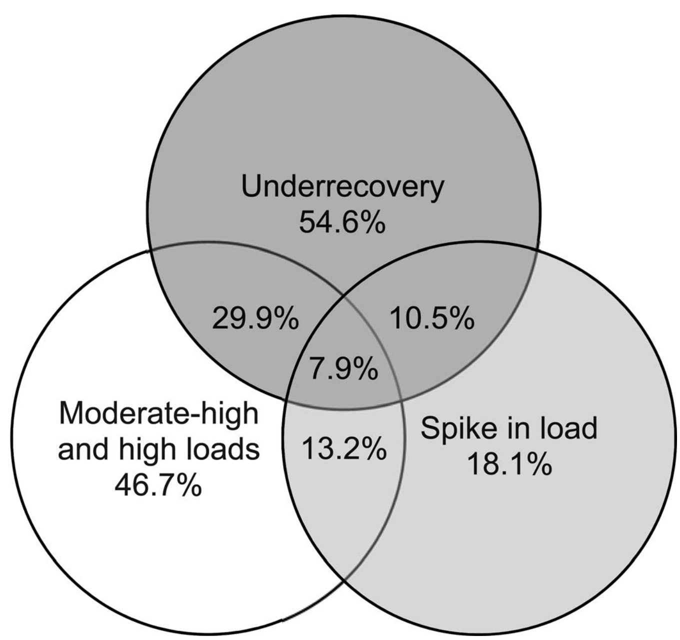

Figure 3. Proportion of gymnasts demonstrating underrecovery state (total quality recovery score < 13), moderate-high (50% ≤ weekly internal training load <75%) or high (weekly internal training load ≥75%) training load or spikes (acute : chronic workload ratio ≥1.5) in load during each week of the season (N = 304).

(41%). Considering this scenario and the negative association between session-RPE and TQR score, we suggest a better distribution of training intensity across the professional rhythmic gymnastics season to allow more recovery during competitive periods.

Kenttä and Hassmén[9] suggested a TQR score of 13 as the minimal level of recovery that athletes must attain, even after days of light training. Based on this approach, our gymnasts were poorly recovered during 50.9% of the season, and at least half of the group was underrecovered during all 5 competition weeks. In contrast to this result, Debien et al[12] reported that the lowest TQR score of professional volleyball players over a season was 13.8 ± 1.4, which occurred during the week with the highest difficulty match score. Despite the use of strategies for optimizing recovery, the process depends on time to adequately repair tissue and reestablish performance.[3] Therefore, the long duration (approximately 3.7 hours per session) and high frequency (8.7 ± 2.9 sessions per week) of training sessions in rhythmic gymnastics[21] disturb this restorative process, making it difficult for athletes to recover appropriately across the season.

In addition to high training load and intensity, other factors that may have impaired recovery in the rhythmic gymnasts were the concentrated high wITLs,[13] spikes in loads,[23] or even a mismatch between coaches' and athletes' perceptions of recovery.[11,17] Moreover, our results showed that the athletes were not appropriately recovered during 74.2% of the high-intensity weeks and the TQR score was >13 during 70.3% of the low-intensity weeks. Certainly, the multifactorial and individual nature of recovery reflects more than simple training loads; other aspects, such as sleep, social life, and nutrition, also affect the athletes' perceived recovery,[3,5] although we did not analyze them. The complexity of the relationship among training, recovery, and performance increases the importance of frequent, individual, and multivariate management of training and its responses. Furthermore, recovery should also be carefully planned, with the best individual strategies chosen to ensure better performance and less maladaptation during critical periods.[3]

The ACWR model has been used to safely progress training loads and manage injury risk in several team sports. This variable captures the training load performed in a short time period (ie, acute load) relative to the training load over a longer time (ie, chronic load).[22,23] Small fluctuations in training load (within an ACWR range of approximately 0.8 to 1.3) have been associated with a low injury risk, whereas higher ACWRs (≥1.5) have been associated with an increased injury risk.[22] We observed no correlations between ACWR and recovery, yet our results revealed 55 individual occurrences of spikes in load (ACWR ≥ 1.5) and increases in ACWR during competitive periods 2 and 3. Several authors[32–34] have encouraged practitioners to use the ACWR in combination with other variables when interpreting athlete-monitoring data. How the ACWR could be used in conjunction with other monitoring tools as a multidimensional athlete management system to contribute to decision making in the practical environment is highlighted in Figures 2 and 3.

In addition to ACWR, other training-load–derived metrics, such as monotony and strain, could provide relevant information related to training outcomes. *Monotony* represents the variability in the training stimulus, whereas *strain* is the product of monotony and training load.[6] In a study of female collegiate basketball athletes, Anderson et al[35] found a higher injury incidence when rapid increases in load occurred (ie, spikes) at the beginning of the season and after a week off. However, no conclusive results were demonstrated for monotony and strain.[35] The only study[16] in which researchers investigated ACWR among rhythmic gymnastics was conducted in young amateur athletes. Even though they recognized the need for further research, the authors[16] suggested that an ACWR between 1.2 and 1.4 might be a safe strategy to control training intensification (4-week period) in this population without impairment of mucosal immunity. Given the paucity of research in rhythmic gymnastics, further investigation is needed to better understand the interactions of training-load metrics, such as ACWR, monotony, and strain, as well as recovery, injury, and performance.

Our study had possible limitations. Our findings may be considered novel, but other national senior rhythmic gymnastics groups may present different training-load and recovery profiles over the season. Researchers should examine different training-load methods and other national rhythmic gymnastics groups and individuals, thoroughly analyze rhythmic gymnasts' daily training and competition demands, and assess the specific requirements of rhythmic gymnastics coaches and practitioners to improve their outcomes in the field.

CONCLUSIONS

The season of a professional senior rhythmic gymnastics group presents a particular and varied training-load distribution. Despite the high absolute magnitude of wITL, most wITL and session-RPE intensities across the season were moderate. Training-load variables increased during competitive periods. During half of the season, gymnasts were not adequately recovered, especially in competition weeks. The periods of underrecovery were more frequent when associated with high-intensity training and ACWRs ≥1.5, reinforcing the negative association between ITL variables and TQR score. Despite this negative relationship, high training loads alone did not cause underrecovery; it is also essential to manage the what (type and content), how (progression), and when (period) of these workloads applied across a professional rhythmic gymnastics season.

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