MONITORING TRAINING LOAD AND RECOVERY IN VOLLEYBALL PLAYERS DURING A SEASON

MONITORAMENTO DA CARGA DE TREINAMENTO E RECUPERAÇÃO EM JOGADORES DE VOLEIBOL DURANTE UMA TEMPORADA

MONITOREO DE LA CARGA DE ENTRENAMIENTO Y RECUPERACIÓN EN JUGADORES DE VOLEIBOL DURANTE UNA TEMPORADA

Original Article
Artigo Original
Artículo Original

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ABSTRACT

Introduction: Monitoring training loads, along with the recovery status, is important for preventing unwanted adaptations. Knowledge of these variables over volleyball seasons is still scarce. Objective: To monitor and describe the training load and recovery status of volleyball players over a competitive season. Methods: The sample consisted of 14 professional volleyball players. For the entire season, the training load was monitored daily by the SPE method during the session, and the recovery status was monitored by TQR and QBE on the first and last days of training for the week. Results: There was a decrease in training load between Preparatory Period I and Competitive Period I ($p = 0.03$), followed by an increase in Preparatory Period II ($p < 0.001$) and a new decrease in Competitive Periods II ($p = 0.01$) and III ($p = 0.003$). There was a significant reduction between Pre-TQR and QBE and Post-TQR and QBE in all mesocycles. In the Pre-TQR, there was a reduction between Preparatory Period II and Competitive Period II ($p = 0.006$), in the Pre-QBE, there was a reduction between Preparatory Period II and Competitive Period III ($p = 0.002$), and in the Post-TQR, this reduction was observed between Competitive Period I and Preparatory Period II ($p = 0.03$). In the Post-QBE, there was an increase between Preparatory Period I and Competitive Period I ($p = 0.002$), followed by a decrease in Preparatory Period II ($p = 0.01$). Conclusion: Loads varied throughout the season, along with recovery, which varied according to the loads and characteristics of each period. ***Level of evidence I, Therapeutic Studies – Investigating the Results of Treatment.***

Keywords: Volleyball; Monitoring; Recovery.

RESUMO

Introdução: O monitoramento das cargas de treinamento junto com o estado de recuperação é importante na prevenção de adaptações indesejadas. Ainda é escasso o conhecimento dessas variáveis ao longo das temporadas de voleibol. Objetivo: Monitorar e descrever a carga de treinamento e o estado de recuperação de atletas de voleibol ao longo de uma temporada competitiva. Métodos: A amostra foi composta de 14 atletas profissionais de voleibol. Ao longo de toda a temporada, a carga de treinamento foi monitorada diariamente pelo método da PSE da sessão e o estado de recuperação foi monitorado pela TQR e QBE, no primeiro e último dia de treinamento da semana. Resultados: Houve queda na carga de treino do Período Preparatório I para o Período Competitivo I ($p = 0,03$), seguida de aumento no Período Preparatório II ($p < 0,001$) e nova queda no Período Competitivo II ($p = 0,01$) e III ($p = 0,003$). Ocorreu redução significativa da TQR e QBE Pré para a TQR e QBE Pós em todos os mesociclos. Na TQR Pré houve queda do Período Preparatório II para o Período Competitivo II ($p = 0,006$), já na QBE Pré houve redução do Período Competitivo II para o Período Competitivo III ($p=0,002$) e na TQR Pós essa diminuição foi observada do Período Competitivo I para o Período Preparatório II ($p = 0,03$). Na QBE Pós observou-se aumento do Período Preparatório I para o Período Competitivo I ($p = 0,002$), seguido de queda no Período Preparatório II ($p = 0,01$). Conclusão: As cargas apresentaram variação ao longo da temporada, juntamente com a recuperação, que variou em função das cargas e das características de cada período. ***Nível de evidência I; Estudos terapêuticos – Investigação dos resultados do tratamento.***

Descritores: *Voleibol; Monitoramento; Recuperação.*

RESUMEN

Introducción: El monitoreo de las cargas de entrenamiento junto con el estado de recuperación es importante en la prevención de adaptaciones no deseadas. Todavía es escaso el conocimiento de esas variables a lo largo de las temporadas de voleibol. Objetivo: Monitorear y describir la carga de entrenamiento y el estado de recuperación de atletas de voleibol a lo largo de una temporada competitiva. Métodos: La muestra fue compuesta de 14 atletas profesionales de voleibol. A lo largo de toda la temporada, la carga de entrenamiento fue monitoreada diariamente por el método de la PSE de la sesión y el estado de recuperación fue monitoreado por TQR y QBE, en el primer y último día de entrenamiento de la semana. Resultados: Hubo una caída en la carga de entrenamiento del Período Preparatorio I para el Período Competitivo I ($p = 0,03$), seguida de un aumento en el Período Preparatorio II ($p < 0,001$) y una nueva caída en el Período Competitivo II ($p = 0,01$) y III ($p = 0,003$). Se produjo una reducción significativa de la TQR y QBE Pre para la TQR y QBE Post en todos los mesociclos. En la TQR Pre hubo caída del Período Preparatorio II para el Período

Competitivo II (p = 0,006), ya en la QBE Pre hubo reducción del Período Competitivo II para el Período Competitivo III (p = 0,002) y en la TQR Post esta disminución fue observada del Período Competitivo I para el Período Preparatorio II (p = 0,03). En la QBE Post se observó aumento del Período Preparatorio I para el Período Competitivo I (p = 0,002), seguido de caída en el Período Preparatorio II (p = 0,01). Conclusión: Las cargas presentaron variación a lo largo de la temporada, junto con la recuperación, que varía en función de las cargas y de las características de cada período. ***Nivel de evidencia I, Estudios terapéuticos – Investigación de los resultados del tratamiento.***

Descriptores: *Voleibol; Monitoreo; Recuperación.*

DOI: http://dx.doi.org/10.1590/1517-869220192503195048 Article received on 05/05/2018 accepted on 01/31/2019

INTRODUCTION

Sports training aims to improve athlete performance. To achieve this, the training load must be appropriately applied in terms of intensity and volume, followed by a recovery period to prepare the athlete's body for new loads. During this period, the the athlete's physical, psychological and sports capabilities are restored.[1-4]

In collective sports, the annual calendar usually consists of a preparatory period[5,6] followed by the competitive period. The main competitive season (Superliga) of Brazilian volleyball lasts for five to six months and usually consists of games held once or twice a week.[7] It is thus important to monitor the athletes during this period, allowing them to execute the planned training load and achieve the expected performance.[8]

It is important to monitor the training load along with the recovery state, making sure that the recovery periods are consistent with the training loads, minimizing any negative training adaptations.[1,2,9]

Different tools can be used to monitor the athlete's load and recovery. Of these tools, the psychometric ones have been effective and are simple, easily applied and inexpensive.[10-13] The tools used to assess recovery include the Total Quality Recovery (TQR) scale and the Well-Being Questionnaire (WB).[2,11]

Although some studies monitor training loads in volleyball at some points during the season,[14-16] there is still a lack of studies on the recovery state behavior along the season, of how the characteristics of some periods will influence it to help understand the recovery and its variables in volleyball.

The objective of this study was to monitor and describe the training load and recovery state of volleyball athletes during a competitive season, and to compare the behavior of these variables at different times of the season.

METHODS

Sample

The study included 14 male athletes from an adult volleyball team competing in the National Superliga championship, with mean age of 24.0±3.59 years, body mass of 96.87±9.85 kg, height of 194.36±6.9 cm, fat percentage of 7.58±1.91%.

The athletes were informed of the potential risks involved in the process and attested to voluntary participation. They allowed the use and dissemination of information. This study has been approved by the Research Ethics Committee under no. 964.012.

This study was carried out during a competitive season lasting 35 weeks, divided into five mesocycles named as follows:

- Seven weeks of preparatory period I,
- Five weeks of competitive period I,
- Eight weeks of preparatory period II,
- Eight weeks of competitive period II,
- Seven weeks of competitive period III.

During the competitive period I, the athletes participated in a state competition; competitive period II corresponds to the first round of the national competition and competitive period III corresponds to the second round of the same competition. During preparatory periods I and II, friendlies and regional championships were performed.

Internal load monitoring was performed using the subjective perceived exertion method.[17] Thirty minutes after the end of each training session, the athletes answered the following question: "How was your training?", based on Borg CR10 adapted scale. To calculate the training load (TL), the marker recommended by the athlete multiplied by the training time was used. On days with two training shifts, the TL of the sessions was added up. The total weekly training load (TWTL) was calculated by adding up the daily TLs of the week. As the periods presented different durations, the mean TWTL of each period was determined.

To monitor the recovery state, the Total Recovery Quality Scale (TQR) was used.

This scale was proposed in order to evaluate general recovery. Athletes answered the question "How do you feel about your recovery?", based on the scale proposed by Kentta and Hassmen,[2] in which 6 corresponds to "Not recovered" and 20, "Completely recovered." The athletes responded to the scale on the first and last day of training or game in the week.

To evaluate subjective perception of fatigue, sleep quality, general muscular pain, stress level and mood, the Well-Being Questionnaire (WB) proposed by McLean, Coutts[11] was applied based on the recommendations of Hooper and Mackinnon.[18]

This is a psychometric questionnaire in which the five previously mentioned items are evaluated in scales ranging from one (worst values) to five (best values) points, and each one of these values is accompanied by a specific descriptor of the item evaluated. The total Sum of all scales generates a value that is considered Total Well-Being. The athletes answered the scale on the first and last day of training or game of the week.

Statistical analysis

Descriptive statistics is presented as mean±standard deviation. Data normality was confirmed using the Shapiro-Wilk test. In order to test differences in TWTL, WB and TQR among the mesocycles, repeated measures ANOVA was used, followed by multiple comparison of means with Bonferroni correction. When the sphericity assumption was not met, the degrees of freedom were corrected by Huynh-Feldt's epsilon. For this analysis, the mean of the variables in the respective weeks of each mesocycle was considered. To test correlations between the variables WB, TQR and TWTL, Pearson's correlation coefficient was used. To test correlations between WB and TWTL, Spearman's correlation test was used. All analyses were conducted in the statistics software SPSS version 20.0 (IBM Corp., Armonk, NY), adopting a significance level of 5%.

RESULTS

Table 1 shows the descriptive values of TWTL, WB and TQR in the different mesocycles of the season. A significant difference was observed in TL ($F_{(4,52)}$=12.147; p<0.001; eta^2=0,48), in the Pre WB ($F_{(4,52)}$=6.532; p<0.001; eta^2=0.33), Post WB ($F_{(4,52)}$=2.942; p=0.03; eta^2=0.18), Pre TQR ($F_{(4,52)}$=5.262; p=0.001; eta^2=0.29) between the mesocycles. On the other

hand, no significant difference was observed in the Post TQR ($F_{(4.52)}$=1.032; p=0.40, eta^2=0.07) among the mesocycles.

There was a decrease in the TWTL of Preparatory Period I for Competitive Period I (p=0.03), followed by an increase in the TL of Preparatory Period II (p<0.001) and a new decrease in Competitive Period II (p=0.01) and III (p=0.003). The statistical differences found were between successive periods. (Figure 1)

There was a significant reduction from Pre TQR to Post TQR in all mesocycles. (Figure 2)

In all mesocycles, there was a significant difference in Pre WB vs. Post WB, with a decrease in General Well-Being at the end of the week compared to the beginning of the week. (Figure 3)

Considering the whole season, a positive and statistically significant correlation was observed between Pre WB and Pre TQR, (r=0.63; p<0.001; n=392). There was also a positive and statistically significant correlation between Post WB and Post TQR (r=0.45; p<0.001; n=392). Besides, TL showed a negative and statistically significant correlation with Post WB (r=-0.23; p<0.001; n=392) and with Post TQR (r=-0.36; p<0.001; n=392).

Considering the periods of the season, a negative and statistically significant correlation was found between post-training fatigue (r=-0.3; p<0.003; n=98), post-training sleep quality (r=-0.35; p<0.001; n=98), post-training humor (r=-0.423; p<0.001; n=98) and post-training stress level (r=-0.3; p<0.003; n=98) and the TWTL of preparatory period I. In competitive period I, there was a negative and statistically significant correlation between post fatigue (r=-0,25; p<0.04; n=70) e post general muscular pain (r=0.35; p<0.003; n=70) and TWTL. In preparatory period II, there was a negative and statistically significant correlation between post fatigue (r=-0.29; p<0.004; n=98) and TWTL. This correlation also occurred in competitive period II, but with other values (r=-0.31; p<0.019; n=55). In competitive period III, no significant correlations were found.

Table 1. Mean±standard deviation of training load (TL), perceived well-being (WB) and recovery (TQR) at the beginning of the week (Pre) and at the end of the week (Post) of a volleyball team (n=14) over 5 mesocycles of the season.

	TWTL	Pre WB	Post WB	Pre TQR	Post TQR
Preparatory period I	3664.4±508.6	19.9±1.4	17.4±1.8	16.4±1.3	14.5±1.1
Competitive period I	3384.6±570*	19.8±1.2	18.7±1.5*	16.4±0.9	14.7±1.1
Preparatory period I	4546,±620.9*	20.2±1.8	17.7±1.3 *	16.7±1.1	14.1±0.8 *
Competitive period II	4006.6±687.6*	20.4±1.7	18.1±1.5	15.9±1.1*	14.3±1.3
Competitive period II	3599.8±853.7 *	18.5±2.1*	17.8±1.1	15.7±1.1	14.2±1.1

(*Significant differences between the mesocycles; p<0.05).

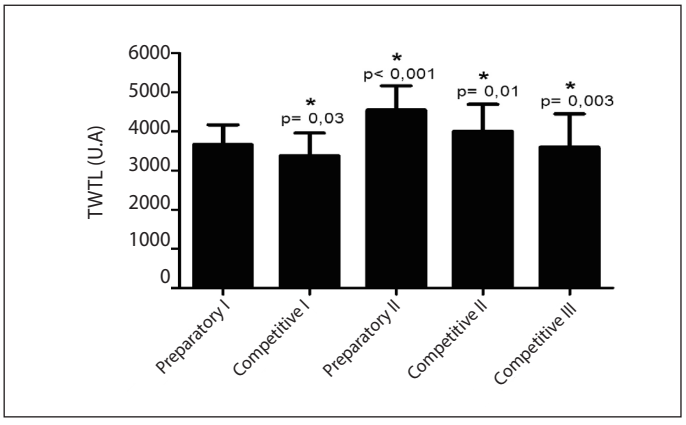

Figure 1. Mean±standard deviation of the training load (TL) of a volleyball team (n=14) measured over five mesocycles of the season (*Significant differences found compared to the previous mesocycle, p<0.05).

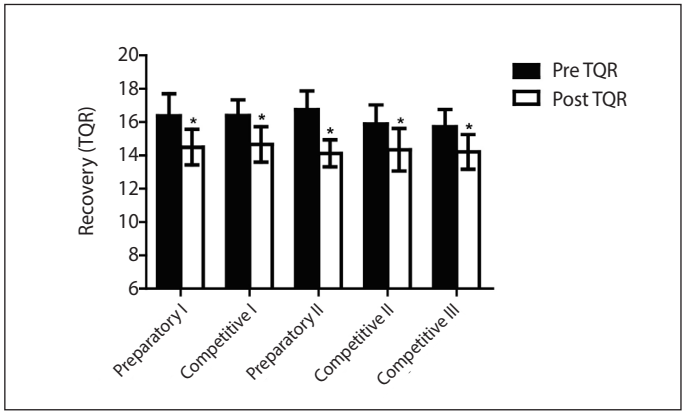

Figure 2. Mean±standard deviation of the total quality recovery (TQR) at the beginning and at the end end of the week for a volleyball team (n=14) measured over five mesocycles of the 2012/2013 season. (*Significant differences between Pre TQR and Post TQR; p<0.05).

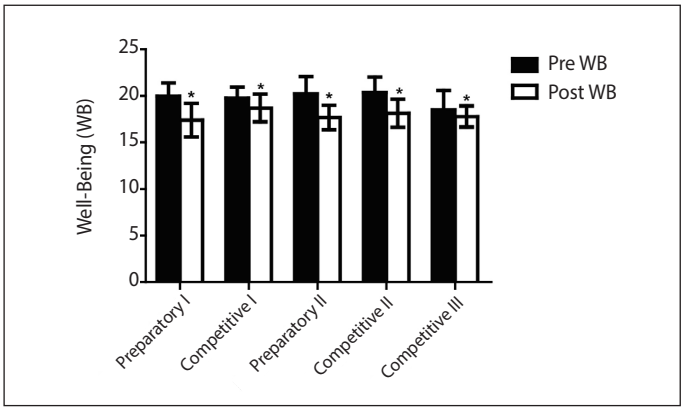

Figure 3. Mean±standard deviation of Well-Being Questionnaire (WB) at the beginning and at the end of the week of a volleyball team (n=14) measured over five mesocycles of the 2012/2013 season. (*Significant differences between Pre WB and Post WB; p<0.05).

DISCUSSION

This study aimed to monitor training loads and recovery state during different periods of the season.

The results showed that the training load fluctuated according to the characteristics of each mesocycle. Manzi and D'Ottavio[19] found a significant difference in TWTL in weeks with and without matches; the training loads for weeks without games were higher than those in weeks with one or two games, corroborating our findings for the decreased TWTL in competitive periods.

Regarding the load values found in other studies with volleyball athletes, only one was similar to the values found in this study, with values ranging from 4138±664 to 4427±409 U.A during two weeks of intensification of training loads.[15] In the study by Horta et al.[16], the load values found during the preparatory period were higher (5942±962 U.A) compared to our study.

According to our results, the TQR and WB methods for the quantification of recovery state were sensitive to the load variation during the season. The behavior of these variables at the beginning and at the end of each period was possibly related to the load applied during the period, proving to be useful tools to monitor the responses of applied loads.

The differences found in post-TQR between competitive periods I and preparatory period II can be explained by the magnitude of the loads applied in both periods. A similar result was reported by Freitas and Nakamura[15] in volleyball athletes. Suzuki and Sato[13] also demonstrated this characteristic in a case study with race athletes: during the season where the TL was higher, the TQR was lower. This demonstrates that TQR can also be a TL control tool.

The difference found in pre TQR between preparatory period II and competitive period II is possibly due to the characteristics of the competitive period in question, with games played twice a week with intervals shorter than or equal to 48 hours between them, trips and limited number of days off. During this period, strategies should be adopted to make sure the athletes' recovery state is not further impaired during the week, such as training in a period of the day, seeking an alternative to increase the athletes' free time during the competitive period and using methods that accelerate the recovery process between the matches.[9,20]

This is the first study, to our knowledge, that used the Well-Being Questionnaire (WB) in volleyball athletes during a full season. The results indicated that in preparatory periods I and II, post WB was statistically lower in both periods compared to competitive period I. This can be explained by the training loads applied in each period analyzed. Buchheit and Racinais[21] demonstrated that WB was sensitive to training load variations during the preparatory period in soccer players.

The correlation values found between TQR and WB, both in pre collection (r=0.63) and in post collection (r=0.45), show that these have consistent measures and that one adds information to the other. TQR is a simpler tool, while WB provides more detail about recovery factors.

In preparatory period I, of the five items assessed by WB at the end of the week, four presented a significant correlation with TWTL. It is believed that with the resumed training routine, this period with high loads may have generated such responses.[6,22] In preparatory period II, fatigue was the only item that showed a significant correlation with TWTL, indicating a better adaptation of the athletes.

CONCLUSION AND PRACTICAL APPLICATIONS

The results of this study allow us to conclude that the internal training loads varied throughout the season, indicating higher loads in the preparatory periods compared to the competitive periods in volleyball. It is considered that the recovery of athletes varied according to the loads and characteristics of the period in which the team was in the season. Besides, these results confirm the effectiveness of the subjective perceived exertion method for monitoring training load in volleyball. The Total Quality Recovery Scale (TQR) and Well-Being Questionnaire (WB) were effective in monitoring recovery, which was shown to be sensitive to the training loads applied during the season.

ACKNOWLEDGEMENTS

The authors acknowledge Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for their financial support.

All authors declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. TSD (0000-0002-7394-8519)*: contributed substantially to writing the manuscript and the conception of the work; DRC (0000-0002-6055-0667)*: contributed substantially to the conception of the work and critical review of the intellectual content; RM (0000-0002-1127-8513)*: took part in the final approval of the version and critical review of the intellectual content of the manuscript; HCT (0000-0001-6066-9011)*: took part in the final review of the version and critical review of the intellectual content of the manuscript; FZW (0000-0003-1966-8820)*: performed the statistical analysis of the data and interpretation of the results; DGSF (0000-0002-2494-3287)*: contributed substantially to the conception of the work and critical review of the intellectual content; MGBF (0000-0003-1219-8379)*: took part in the final approval of the version and contributed substantially to the conception of the work and critical review of the intellectual content. All authors approved the final version of the manuscript. *ORCID (Open Researcher and Contributor ID).

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