

# Analysis of Overtraining Symptoms during Training and Rehabilitation Periods: A Case Study of Women's Volleyball Super League Team 2003/2004



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## ABSTRACT

Overtraining is a process involving progressively increased training to a high absolute level that is in excess of more routine training undertaken to maintain performance. However, its excessive increase may impair the physical and mental health of the athlete. The aim of this study was to keep up with levels of stress and recovery of volleyball athletes during the Brazilian Women's Super League 2003/2004. 16 athletes ( $23,63 \pm 6,40$  years) were evaluated during two periods, training and rest by answering a stress and recovery questionnaire (RESTQ-Sport-76). Stress levels were measured through the scales 1 to 7 (general stress) and 13 to 15 (stress sports). Its results showed significant differences between perceptions of athletes in all scales ( $p \leq 0.05$ ) during training and rest. Levels of sports and general recovery are known through nine scales. In five of them (9, 10, 11, 12 and 16) there were significant differences ( $p \leq 0.05$ ) and in four, (8, 13, 14 and 15) there was low recovery by the athletes. The conclusion is that RESTQ-Sport-76 was able to assess stress and recovery levels in volleyball athletes and this group demonstrated low recovery during training period.

**Keywords:** stress, high performance, athletes.

## INTRODUCTION

High performance sport has been during its evolution demanding constant performance increase from the athletes in all modalities<sup>(1)</sup>.

During a period of intense training, some athletes may present decrease in their performance, which has been attributed to some psychological and physiological processes<sup>(2)</sup>. When the training intensity and volume surpass the body's recovery and adaptation capacity, the organism may present excessive fatigue episodes<sup>(2)</sup>. This process of excessive loads in training, combined with insufficient recovery time is named overtraining<sup>(3)</sup>.

The overtraining syndrome, or simply overtraining, is defined by many researchers as imbalance between stress and recovery, where the stressing factors of physical, psychological and social order combined with the short recovery time lead to deleterious effects in the athletes' performance<sup>(1-6)</sup>.

Thus, stress is understood as the total of organic adaptation reactions, which had the aim to maintain or reestablish the inner and/or outer balance. From the psychological point of view, stress is related to the activation of the cognitive functions and is generally understood as a psychological demand or mental activity<sup>(7)</sup>.

Recovery is a process through which the psychological consequences concerning stress, caused by previous activities, are balanced and the functional capacity restored<sup>(8)</sup>. It is a physiological, psychological and social process, and some of these systems can be trained while others are recovering<sup>(9)</sup>.

In the daily routine of a team of high performance, in which frequency of games is high, it is important to develop and apply strategies for the monitoring of the stress and recovery levels which are of fast applicability in the athletes and efficient in the diagnosis of possible risk factors of overtraining<sup>(4,10-14)</sup>.

It is also important to consider that the athlete suffers psychophysiological alterations on the stress level during the season, depending on the overload and training and competition phases<sup>(12)</sup>. These variables highlight the importance of periodical and efficient monitoring of the stress and recovery of each athlete in the team, aiming to reach the maximum individual performance as possible and prevent the deleterious effects related to overload.

One of the most used variables in the monitoring of sports training programs, especially in high load phases<sup>(15)</sup>, is the stress and recovery perception through the recovery-stress questionnaire for athletes (RESTQ-Sport)<sup>(11,16,17)</sup>. This variable has been mainly used in studies which investigate the correlation between different training loads and their effect on the psychological status in athletes of different sports modalities<sup>(16-20)</sup>.

Thus, the aim of the present study was to monitor the stress and recovery levels of a high-performance women's volleyball team during a national competition.

## METHOD

### Sample

This study was approved by the Ethics in Research Committee of the University Center of Belo Horizonte – UNI-BH (Ethical Legal Opinion 25/2006) and all information concerning the study was carefully passed to the athletes who in the sequence signed a written authorization and consent form.

Psychological variables were assessed in a high-level Brazilian volleyball team composed of 16 female athletes, mean age of  $23.63 \pm 6.40$  years who played the Women's Volleyball Super League, 2003/2004, using the recovery-stress questionnaire for athletes (RESTQ-Sport-76) during a season.

The questionnaire (RESTQ-Sport-76), developed by Kellmann and Kallus<sup>(4)</sup>, validated in the Portuguese language by Costa and Samulski<sup>(21)</sup>, is composed of 76 items organized in 19 scales, out of which 12 are general scales and seven scales specific to the sport<sup>(2,13,14)</sup>. These 19 scales are organized in four big dimensions (general stress, general recovery, stress in sports and recovery in sports)<sup>(2)</sup>.

The dimensions evaluate potentially stressing and recovery events within and outside the sports environment<sup>(22)</sup>. The items of the instrument were answered using a Likert scale of seven points, which ranges from 0-never to 6-always<sup>(23)</sup>.

The stress and recovery levels of the team were grouped according to the large dimensions of the instrument. The "General Stress" dimension refers to the perception of the athletes under stressing conditions outside the sports environment, and the "Stress in Sports" dimension involves more specific conditions of the sports life of the athlete. The "General Recovery" dimension refers to the daily recovery strategies of the extra-sports environment and the "Recovery in Sports" dimension is related to the perception of the control and recovery specific strategies of the demands in sports.

The questionnaire was applied in seven distinct moments during the competition, and these moments were grouped in two blocks, named training period and rest period. Training period is the days of the microcycle in which the athletes trained or played official matches of the competition, while the rest period may be defined by the days in which the athletes did not have any kind of activity in the club.

Descriptive analysis composed of mean and standard deviation was used for data treatment and determination of the stress and recovery levels. Periods were compared (Training x Rest), with the use of inferential statistics (T test for paired samples), and significance level adopted was  $p < 0.05$ . All statistic procedures were used in the SPSS software for Windows, version 13.0.

## RESULTS

When the scales which compose the General Stress and Stress in Sports dimensions are analyzed, it is observed that the training period caused significant increase ( $p < 0.05$ ) in the stress perception when compared to the rest period (table 1).

Concerning the scales of the General Recovery dimension (table 2), it can be observed that all scales presented more favorable scores in the rest period and significant differences have not been found,

except for the "Success" scale. In the Recovery in Sports scales, it was observed that only the "To be fit" dimension presented significant difference ( $p = 0.014$ ), being more efficient in the rest period, as demonstrated in table 2.

It can be observed in table 1 that training significantly increased ( $p = 0.000$ ) the stress levels in all dimensions (General and Sports) in the two training blocks (training period and rest).

Additionally, the General Recovery dimension was better in the rest period when compared to the training period, while in the Recovery in Sports dimension there was not difference (figure 2).

**Table 1.** Scales of the "General Stress" and "Stress in Sports" dimension in the Training and Strength periods.

| Situations Dimensions          | Rest               | Training           |       |       |
|--------------------------------|--------------------|--------------------|-------|-------|
|                                | Mean ( $\pm$ sd)   | Mean ( $\pm$ sd)   | t     | Sig   |
| <b>General Stress</b>          |                    |                    |       |       |
| 1. General stress              | 0.30 ( $\pm$ 0.38) | 1.16 ( $\pm$ 0.77) | 3.333 | 0.003 |
| 2. Emotional stress            | 0.73 ( $\pm$ 0.45) | 1.98 ( $\pm$ 0.92) | 4.048 | 0.001 |
| 3. Social stress               | 0.32 ( $\pm$ 0.32) | 1.02 ( $\pm$ 0.83) | 2.643 | 0.016 |
| 4. Conflicts/pressure          | 1.39 ( $\pm$ 0.90) | 2.68 ( $\pm$ 1.05) | 3.112 | 0.005 |
| 5. Fatigue                     | 0.61 ( $\pm$ 0.52) | 3.20 ( $\pm$ 1.33) | 6.017 | 0.000 |
| 6. Energy loss                 | 0.64 ( $\pm$ 0.32) | 1.50 ( $\pm$ 0.86) | 3.121 | 0.005 |
| 7. Somatic complaints          | 0.95 ( $\pm$ 0.65) | 3.02 ( $\pm$ 0.94) | 6.008 | 0.000 |
| <b>Stress in Sports</b>        |                    |                    |       |       |
| 13. Disorders in the intervals | 0.82 ( $\pm$ 0.45) | 3.07 ( $\pm$ 0.86) | 7.698 | 0.000 |
| 14. Emotional exhaustion       | 0.23 ( $\pm$ 0.34) | 1.39 ( $\pm$ 0.88) | 4.057 | 0.001 |
| 15. Injuries                   | 1.66 ( $\pm$ 0.99) | 2.77 ( $\pm$ 1.19) | 2.392 | 0.027 |

**Table 2.** Scales of the "General Recovery" and "Recovery in Sports" dimension in the Training and Rest periods.

| Situations Dimensions     | Rest               | Training           |        |       |
|---------------------------|--------------------|--------------------|--------|-------|
|                           | Mean ( $\pm$ sd)   | Mean ( $\pm$ sd)   | t      | Sig   |
| <b>General recovery</b>   |                    |                    |        |       |
| 8. Success                | 3.89 ( $\pm$ 0.81) | 3.50 ( $\pm$ 0.97) | -1.016 | 0.322 |
| 9. Social recovery        | 4.59 ( $\pm$ 1.06) | 3.33 ( $\pm$ 1.33) | -2.449 | 0.024 |
| 10. Physical recovery     | 3.98 ( $\pm$ 1.41) | 2.34 ( $\pm$ 1.15) | -2.983 | 0.007 |
| 11. General Wellness      | 5.25 ( $\pm$ 0.51) | 4.41 ( $\pm$ 0.92) | -2.655 | 0.015 |
| 12. Sleep quality         | 4.95 ( $\pm$ 0.43) | 3.49 ( $\pm$ 1.44) | -3.222 | 0.004 |
| <b>Recovery in sports</b> |                    |                    |        |       |
| 16. To be fit             | 4.14 ( $\pm$ 1.17) | 2.82 ( $\pm$ 1.14) | -2.683 | 0.014 |
| 17. Personal acceptance   | 4.84 ( $\pm$ 0.71) | 4.09 ( $\pm$ 1.40) | -1.583 | 0.129 |
| 18. Self-efficacy         | 3.80 ( $\pm$ 1.08) | 3.34 ( $\pm$ 0.88) | -1.083 | 0.292 |
| 19. Self-regulation       | 4.05 ( $\pm$ 1.22) | 4.23 ( $\pm$ 1.16) | 0.358  | 0.724 |

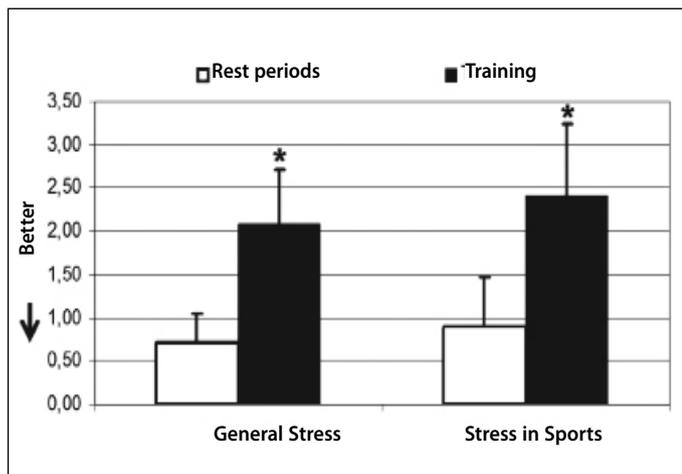


Figure 1. Stress dimensions in the Training and Rest periods (\* $p \leq 0.05$ ).

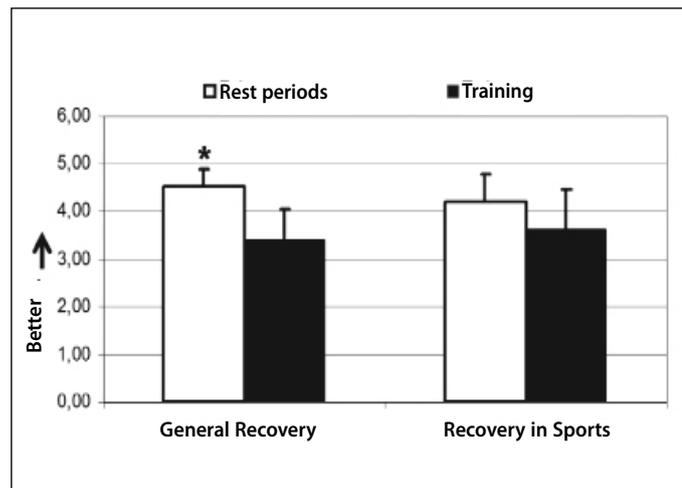


Figure 2. Recovery dimensions in the Training and Rest periods (\* $p \leq 0.05$ ).

## DISCUSSION

In the present study the training period, which was characterized by a phase of high physical loads, aiming the beginning of the competition, and the rest period, characterized by a phase of training intervals and relatively long competitive games (10 days), in which the athletes could return to family interaction and activities of personal interest were compared. It is worth mentioning that the rest period was longer than what is usually offered to the athletes with the purpose to reinforce the rest condition.

Interestingly, the rest period enables the athletes to perceive better efficiency in the recovery processes. Several studies mention that after a rest period recovery is reached and usually improvement in the athlete's performance is observed<sup>(24,25)</sup>. Intense physical training in this study significantly affected ( $p < 0.05$ ) the perception of virtually all recovery dimensions, including sleep quality, in which the athlete may perceive as insufficient. Unsatisfactory sleep perception may be related to perception of the somatic relaxing, which has not reached satisfactory indices in the training period either. Once the training load was placed, higher stress levels and/or lower recovery levels were expected<sup>(16,17,19,20)</sup>. German elite rowers in preparation for the Olympic Games demonstrated a correlation between training volume (indicated by the number of daily intense training minutes) and the subjective evaluation of the stress and

recovery physical components<sup>(19)</sup>. In a recent study, no alterations in the stress and recovery indices have been observed during 24 training weeks of experienced rowers of national and international levels, despite training load increase. Moreover, in the same study reduction in the stress levels and increase in the recovery levels during the monitoring period of these rowers have been observed<sup>(26)</sup>, which does not corroborate the results in this investigation.

In the recovery specific dimension, it is observed that only the "To be fit" scale, more related to the physical aspect, was affected by training ( $p = 0.014$ ). The remaining scales are related to the empathy aspect (Personal acceptance), performance perception (Self-efficacy) and actions preparation/planning (Self-regulation), and the training period did cause significant alterations in the athletes' perception.

A similar study conducted in Brazilian women's volleyball, using the same psychometric instrument to evaluate stress and recovery in a female elite athlete in this sport, presented results which partially corroborate the ones found in this study; the singularities of each investigation will be presented as follows.

Concerning the Recovery (general and sports) dimension, comparing the results of the present study with the case study<sup>(2)</sup> carried out in the same modality, it is verified that the "Success" (2.00), "To be fit" (2.25) and "Self-efficacy" (3.25) scales reached lower values.

Reporting again to the results of the previously mentioned study<sup>(2)</sup>, concerning the Stress in Sports dimension only the "Emotional Exhaustion" scale (2.25) presented higher value compared to the results of this study.

The "Self-regulation" scale refers to the evaluation and use of psychological abilities by the athlete as preparation to improve performance<sup>(27)</sup>. In the present study significant differences have not been found in the "Self-regulation" scale when compared to the training and rest situations.

Thus, monitoring measures of the stress and recovery levels which take into consideration not only the training and rest loads but also outer situations, should be continuously applied in order to avoid chronic overload in the athletes and consequent decrease in performance.

However, although the study has identified stress increase during the training period, this investigation limited to analyze only the differences in the general and sports stress scale not considering the temporal oscillations of the process derived from each training session. The reason for this limitation is of logistic character, due to the trips and training of the team in other states during the Women's Volleyball Super League.

During the rest period of the athletes this temporal limitation of recovery control has also occurred, due to the specific characteristics of the use of free time from the side of each of the athletes.

Therefore, it is concluded that during the training period of this women's volleyball team the stress amount increased, which is within some coherence, established according to the principles of the sports training. Four out of nine recovery indicators during the rest period did not present significant differences, suggesting imbalance between the stress and recovery loads.

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All authors have declared there is not any potential conflict of interests concerning this article.

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