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## The Total Quality Recovery Scale (TQR) as a Proxy for Determining Athletes' Recovery State after a Professional Soccer Match

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### ABSTRACT

**Osiecki R, Rubio TBG, Luz Coelho R, Novack LF Conde JHS, Alves CG, Malfatti CRM.** The Total Quality Recovery Scale (TQR) as a Proxy for Determining Athletes' Recovery State after a Professional Soccer Match. *JEPonline* 2015;18(3):27-32. The purpose of this study was to evaluate the recovery state of 10 male athletes after an official professional soccer match. The Total Quality Recovery Scale (TQR) was used compare the athletes' blood creatine kinase (CK) to their recovery state. The athletes (body mass  $76.1 \pm 7.9$  kg; height  $1.75 \pm 7.0$  m; age  $26.6 \pm 4.5$  yrs old; BMI  $21.66 \pm 1.58$  kg·m<sup>-2</sup>) had their Ratings of Perceived Exertion (RPE) rated 30 min after the match. CK and TQR were obtained 24 hrs thereafter. No significant associations were found between TQR and RPE ( $r = -0.56$ ;  $P > 0.05$ ); and CK and RPE ( $r = 0.60$ ;  $P > 0.5$ ). However, we did find a statistically significant association between TQR and CK ( $r = -0.75$ ;  $P < 0.05$ ). Thus, the findings indicate that TQR could be used in the evaluation of professional soccer athletes to determine recovery state after an official game.

**Key Words:** Physical Stress, Creatine Kinase, Total Quality Recovery Scale (TQR), Professional Athletes, Soccer

## INTRODUCTION

Soccer is the most popular sport in the world. It is practiced by men and women of various ages and levels of expertise (16). With matches every 3 days, professional soccer in Brazil is a sport with a high frequency of games throughout a season. This high number of games is associated with cumulative residual fatigue (13,15) with a noticeable decrease in the performance of athletes (14). Several studies have demonstrated the association of biomarkers with muscle damage and fatigue (1,4). For health reasons, it is important to assess the biomarkers to evaluate the recovery state of professional athletes.

Creatine kinase (CK) is an important biomarker of physical effort in soccer (2,7,11). Recent findings have shown that high levels of CK after a soccer match are associated with a decrease in the athletes' performance. For example, Ascensão and Rebelo (2) showed that professional soccer players had a reduction in strength and sprint up to 72 hrs after exercise that elicited high levels of CK. Ispirlidis and Fatouros (11) evaluated 14 soccer players during 6 days after a match and identified that CK concentrations increased gradually, reaching its peak between 48 and 72 hrs after the game. They also found that these athletes had worse performance in sprint and vertical jump tests up to 3 days after the game. These findings show that CK is a good indicator of stress and recovery in athletes.

Another widely used (6,10,17) method to evaluate recovery in athletes is the Total Quality Recovery Scale (TQR) proposed by Kenttä and Hassmén (12). Interestingly, in this regards, Freitas and Nakamura (10) demonstrated that the CK levels of athletes were inversely associated with TQR and that TQR was associated with the athletes' state of recovery. In agreement as to TQR, Suzuki and Sato (17) evaluated 400 m runners during nine separate moments in a season and found that TQR was increased during the competitive period and was strongly associated with performance, training level, and recovery of athletes. These findings suggest that TQR is a good predictor of the recovery state in athletes. Thus, it is likely that the TQR and the athletes' CK may be correlated.

Based on these studies it seems that TQR is a valid alternative for evaluating the state of recovery in soccer players. It should be interesting to investigate the association of TQR with biomarkers of muscle damage and intensity of effort and its use in the physical and physiological evaluation of professional players. Hence, the purpose of this study was to investigate the use of TQR to evaluate the process of recovery in soccer. This is important in that TQR is an easily applicable field test and should provide information in the evaluation and training of professional soccer players.

## METHODS

### Subjects

The study consisted of 10 professional soccer players from a team of the Brazilian first division championship (body mass  $76.1 \pm 7.9$  kg, height  $1.75 \pm 7.0$  m, age  $26.6 \pm 4.5$  yrs old, BMI  $21.66 \pm 1:58$  kg·m<sup>-2</sup>). The goalkeeper and three players that came from the bench during the match were excluded from the study. All subjects signed an informed consent form after verbal and written explanations regarding the study. All methodological procedures were approved by the local Ethics Committee.

### Procedures

All subjects underwent an evaluation after a game of the first division of the professional Brazilian soccer championship. The average length of game play was  $86.6 \pm 7.5$  min. Three subjects in the sample were replaced during the second half of the game while 7 subjects remained in for the 91 min.

## Measurements

All subjects had their height measured with a stadiometer accurate to 1 mm (Sanny®, American Medical do Brazil Ltda., São Paulo, Brazil). Their body mass was measured with a Toledo scale that was accurate to 50 gm (Toledo Brasil®, São Paulo, Brazil).

The subjects' perceived exertion was assessed 30 min after the game using the Borg's Ratings of Perceived Exertion (RPE) - CR10 (5). The fatigue scale was assessed 24 hrs after the game with the Total Quality Recovery (TQR) scale proposed by Kenttä and Hassmén (12). The subjects' CK was measured in the blood of the players (also after 24 hrs of the game) by the Reflotron Sprint® system (F. Hoffmann-La Roche Ltd, Switzerland).

## Statistical Analyses

We used the Shapiro-Wilk test, and we confirmed normality. We described the subjects with means and standard deviations. We used the Pearson correlation coefficient between the variables with statistical significance set at  $P < 0.05$ . All statistical analysis was performed using the Statistica 10 package (Statsoft®, Tulsa Oklahoma, USA).

## RESULTS

We found a statistically significant inverse association between TQR and CK ( $r = -0.75$ ;  $P < 0.05$ ; refer to Figure 1). There was no significant association between TQR and RPE ( $r = -0.56$ ) or between CK and RPE ( $r = 0.60$ ) (both  $P > 0.05$ ).

**Table 1. The Results of Subjects' CK, TQR, and RPE after Playing 91 Min of Soccer.**

Variables	Time (min)	CK (U·L <sup>-1</sup> )	TQR (units)	RPE (units)
Mean ± SD	86.6 ± 7.5	1191 ± 871.2	12.1 ± 2.8	6.7 ± 1.9

## DISCUSSION

To the best of our knowledge, this is the first study to use TQR in the recovery state evaluation of professional soccer players. The fact that is a statistically significant correlation between the subjects' TQR and their CK levels is important. The implication is that, although the TQR is generally used to look at the recovery state of humans, it can also become an important tool for monitoring the recovery in athletes (6,12,16).

Recent studies have shown that information on the recovery state of athletes can help plan the training load and prevent overtraining (8,12,17). Although more research needed on this topic, it appears that the TQR can serve the function of preventing overtraining. Also, it is cheap, easy, and fast to apply in a variety of settings (10).

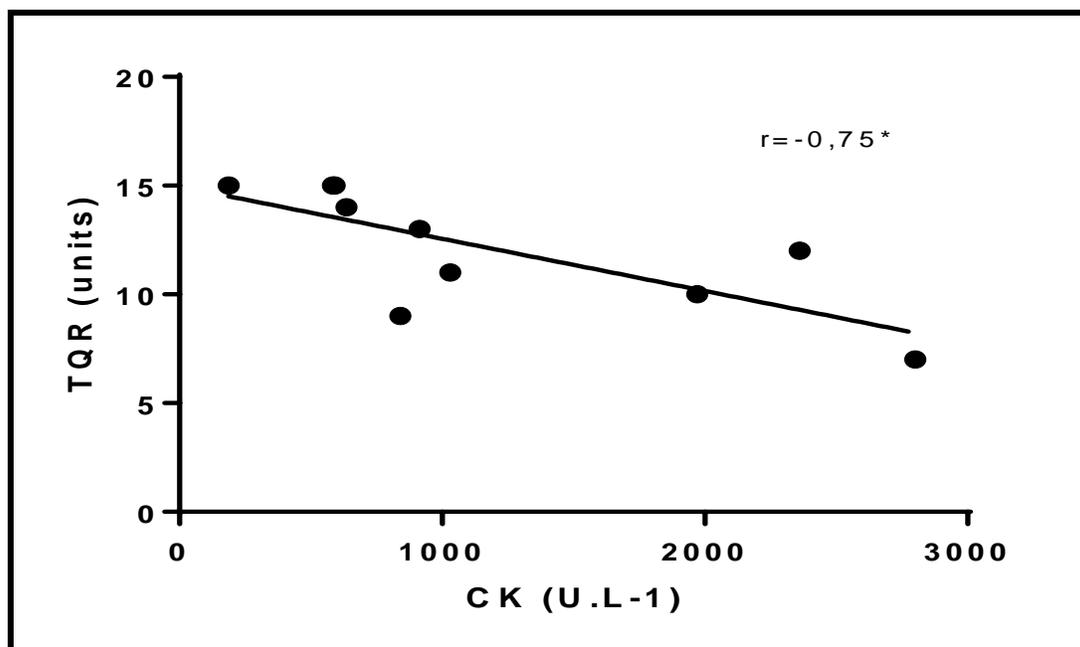


Figure 1. Correlation between TQR (Units) and CK (U·L<sup>-1</sup>) Values. \*P<0.05

This study showed that athletes with the lower TQR values had the highest CK values, which means that the athletes with the lower recovery state in 24 hrs after the match had higher muscle damage. In agreement, a study with volleyball athletes, the CK levels were also inversely associated with TQR (10). This study showed that TQR is highly associated with biomarkers and the recovery state of athletes.

The fact that CK is a muscle damage biomarker, given that it is highly associated with the athletes' degree of physiologic stress after exercise, supports its frequent usage in soccer athletes (3,7,11). Souza et al. (9) showed that CK was significantly different between rest ( $256.1 \pm 23.6 \text{ U}\cdot\text{L}^{-1}$ ), one match ( $372.6 \pm 53.4 \text{ U}\cdot\text{L}^{-1}$ ), and a second match played 24 hrs after that ( $408.8 \pm 68.8 \text{ U}\cdot\text{L}^{-1}$ ). They also published high correlation between CK and performance.

Together, these studies suggest that TQR can be used to evaluate the recovery state of athletes and help plan the training season. In practical terms, TQR is a very attractive method for evaluating the recovery state in soccer teams. These teams have a large number of athletes, and even in the professional setting, repeated laboratorial evaluations are not advised during the training or playing season (10). This makes TQR an ideal method for this purpose. It is cheap, non-invasive, and easily applicable.

### Study Limitations

We acknowledge that the present study has limitations. We did not analyze other muscular stress biomarkers (i.e., lactate dehydrogenase) or hormonal responses to exercise (e.g., testosterone or cortisol). These biomarkers could be influenced by fatigue and the recovery state in athletes as well.

## CONCLUSIONS

Our findings suggest that: (a) TQR can be used to evaluate the recovery state of soccer athletes after a professional match; and (b) it has a good correlation with the athletes' level of biomarkers for muscular damage.

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