Original Article

Stress and mood states monitoring in a swimming team during a competitive period

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Abstract:
The present study aims to identify and analyze stress levels, mood state, as well as the perception of stress and recovery of 32 athletes of both genders, swimmers. In order to quantitatively evaluate the variables the following instruments were used: the Recovery-Stress Questionnaire for Athletes (REST-Q) which describes the mental, emotional and physical well-being of the athletes, the Brunel Mood State Scale (BRUMS) which allows a rapid measurement of mood in populations composed by adults and adolescents and Foster Perception Subjective Effort (PSE) which aims to identify in a quick and simple way of how the practitioners of a certain activity comprises the effort accomplished during the proposed task. The results showed that in the first moments the athletes were in a high mood, which indicates an excellent performance for competitions, later it is possible to notice a reduction in the values of vigor and increase in the other variables, leading the athletes to an imbalance in the standard of the state of mood. Values obtained on the stress and recovery scale changed during the season, with stress indexes increased, while recovery values reduced, indicating susceptibility to injuries and overtire. In this way, the conclusion is that athletes have become more likely to have harmful and overtraining frames over time, thus it is necessary to monitor athlete workloads and perceptions. To better understanding, the states of mood it is necessary to know the athlete deeply and the context which he is present in.
Keywords: mood state, stress, recovery, sport.

Introduction

The stress can be inferred by as a psychophysical destabilization, or, as a disturbance of the person's balance with the environment (Noce el al. 2008). Moreover, it promotes changes in well-being, physiological changes and cognitive functions, as well as in the execution of actions and decision-making. Studies show that the emotional stress caused by the desire to win, fear of failure, and other expectations can be accompanied by a loss of desire to compete and the enthusiasm for training (Noce et al. 2008; Kolling et al, 2015).

The mood of the individual can be altered as his training becomes heavier, also increasing depression, anger, fatigue and decreased vigor. The mood can be defined as the affective factor of the individual, which modifies according to the real perceptions, increasing or reducing the impact of these. Humor accompanies the intellectual processes (perceptions, representations and concepts), leading to a natural modification of the lived experiences. Thus, mood can pass in two extreme poles, one euphoric and the other apathetic, varying according to the circumstances found in the external environment (Dalgalarrondo, 2009).

Another aspect that is commonly affected by stress indices is the mood variation. In general, when the athlete presents a positive state of humor, he has high vigor, associated with low levels of fatigue, anger, tension, depression and mental confusion to show the best sports performance in these conditions (Bertollo et al. 2009; De La Veja, et al. 2014; Halson, 2014). Mood states are directly related to the training load (Raglin, 2001; Aoki et al. 2017). Moreover, studies have shown that the instruments that evaluate the mood states can help to identify possible overtraining and with the detection of a possible syndrome, it is possible to intervene on the athlete before reaching that state (Rohlfs et al, 2005; Lane et al 2000, 2005; Aoki et al. 2017). In view of these considerations, the present study aimed to monitor the states of mood and subjective perception of effort, as well

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as the perception of stress and recovery, at different moments of a training phase and competition period of a swimming team.

Method
Sample
       The sample of this study consisted by swimming athletes (N=32), of both sexes, with an average age of 21 ± 7 years. All the athletes participating in the study were linked to a swimming team from the municipality of Bauru / SP, besides being enrolled to participate in the official competitions organized by the Confederations and Federations, affiliated to the swimming modality, foreseen in the sports calendar of the team. During the training phases, the athletes trained about 5 to 6 days a week, once a day, in specific moments close to the most important competitions the training loads increased, thus passing to two workouts per day.

Proceedings
       The participating athletes were aware about the conditions for joining the study and signed the consent form. The athletes were evaluated individually those who fit in the criteria for the participation of the research were interviewed "in loco". The participants of this study were evaluated at different times such as at the beginning of the competitive preparation, during the competition and at the end of the competition season.

Instruments
       Recovery-Stress Questionnaire for Athletes (RESTQ 76 Sport): consists of a series of statements that indicates the mental, emotional and physical well-being of athletes (Annex 2). The responses were given on a Likert scale. 0. Never; 1. Very few times; 2. Few times; 3. Half of the time; 4. Often; 5. Many times; 6. Always. This questionnaire was developed to measure the frequency of the current stress state in conjunction with the frequency of associated recovery activities. To do so, he assesses potentially stressful events and recovery phases, and their subjective consequences in the last three days and nights (Kellmann *et al.*, 2009).

Brunel's Mood Scale (BRUMS): developed to allow rapid measurement of mood in adult and adolescent populations (Trerry, Lane & Fogarty, 2003). Validated for Portuguese by Rohlfs et al. (2008). The BRUMS contains 24 simple mood indicators, such as the feelings of anger, moodiness, nervousness and dissatisfaction that are perceptible by the individual while he was being evaluated. Six subjective and transient states of humor are evaluated: Tension (T), Depression (D), Anger (A), Vigor (V), Fadigue (F) e Confussion (C). The factors T, D, A, F and C are considered negative factors and Vigor classified as a positive factor. The Total Mood Disorder (TMD) is given by the following calculation: TDH = (T+D+A+F+C) – V + 100 (Morgan et al., 1987). The profile of humor with high value of vigor and low values for the other variables is denominated "profile of iceberg", being representative of positive mental health (Morgan et al., 1987). In the present study, the form put in the question was "How do you feel now" (Morgan et al., 1987)

Subjective Perception of Effort (PSE): The PSE (Foster, 2001), consists of a simple questionnaire, and the athlete must answer the question "how was your training session" within a period of up to 30 minutes after the effort, the athlete responds according to table CR-10. This table consists of a numbering from zero to 10, where zero means the minimum value (rest) and 10 the maximum value (highest effort).

Statistical Analysis
       The data were organized in the form of descriptive statistics the comparative statistical analysis was performed for the means. Significance tests Student's T-test for comparison of paired sample means. The analysis was performed in the statistical program SPSS 15.0 for Windows, adopting the value of significance of 0.05.

Results
       Table 1 presents the results referring to descriptive statistical analysis and variance test during the four selected moments (M). It can be observed in the data a variance in the average values with respect to the factor Tension during the four moments, in addition it presented significant result in the analysis of differences when compared with the moments M2 *versus* M3 (p=0,022), M2 *versus* M4 (p=0,012).

Table 1 Descriptive and Variance Statistics of the BRUMS and REST-Q Instruments during the selected moments.

	Averages BRUMS						
	Tension	**Depression**	**Anger**	**Vigor**	**Fatigue**	**Confusion**	**TMD**
M1	$4,72 \pm 3,14$	$1,52 \pm 2,32*$	$1,66 \pm 2,04*$	$10,72 \pm 2,86*$	$5,55 \pm 3,75*$	$2,31 \pm 2,38*$	$105,1 \pm 10,45$
M2	$4,1 \pm 2,98*$	$2,89 \pm 3,77*$	$2,89 \pm 3,63*$	$7,79 \pm 2,82$	$7,45 \pm 3,21*$	$3,21 \pm 3,24*$	$112,75 \pm 13,85$
M3	$4,76 \pm 2,46$	$3,69 \pm 2,58$	$3,41 \pm 3,09$	$7,10 \pm 1,95$	$6,76 \pm 2,69*$	$3,76 \pm 2,28$	$115,27 \pm 8,93$
M4	$4,86 \pm 2,40$	$3,79 \pm 2,48$	$3,62 \pm 2,76$	$7,48 \pm 1,60$	$6,62 \pm 2,46$	$3,82 \pm 2,17$	$115,24 \pm 8,77$

	Averages REST-Q	PSE

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	S. General	S. Specifc	s. Global	R. General	R. Specific	R. Global	
M1	1,99 ± 0,72	2,38 ± 0,84	2,19 ± 0,70	3,26 ± 0,83	**3,80 ± 0,99***	**3,53 ± 0,85***	7,17 ± 1,17
M2	**2,01 ± 0,88***	2,27 ±1,01	2,14 ± 0,85	3,16 ± 0,89	3,31 ± 0,97	**3,23 ± 0,84***	7,01 ± 0,90
M3	2,13 ± 0,90	2,33 ± 1,02	2,23 ± 0,83	3,14 ± 0,87	3,31 ± 0,97	**3,23 ± 0,83***	8,55 ± 1,06
M4	2,07 ± 0,91	2,24 ± 0,91	2,15 ± 0,80	3,13 ± 0,91	3,34 ± 0,93	3,24 ± 0,84	6,02 ± 0,82

Legend – "M" refers to the Moment. In the data presented by Brums, TMD is the "Total mood DIsturbance". In the data presented for the Rest-Q instrument the "S" represents Stress and "R" Recovery. PSE represents the "Subjective Perception of Effort". * presents significant value referring to difference analysis adopted (p <0.05).

The Depression factor (table 1) has increased its mean values, but there was statistical difference only in the M1 *versus* M2 (p=0,002); M2 *versus* M3 (p=0,003). When analyzing the Anger factor an increase in average values can be noticed when the four moments are compared especially when we compare moment 1 (1,66 ± 2,04) and moment 4 (3,62 ± 2,76). The results (table 1) has presented significant differences between the moments: M1 *versus* M3 (p=0,004), M1 *versus* M4 (p=0,001), M2 *versus* M3 (p=0,019), M2 *versus* M4 (p=0,009). Vigor during the periods presented a reduction in the mean values, the M1 (10, 72 ± 2, 86) presented the highest value throughout the study, while the M2 (7,10 ± 1,95) the lowest mean at any time of the study. The M1 of this variable presented a difference when compared to the other moments. The fatigue factor (Table 1) presented an increase in mean values between all moments from the study M1 presented the lowest value (5.55 ± 3.75) while M2 presented the highest (7.45 ± 3.21). Fatigue presented a significant difference between moments M1 and M2 (p = 0.037); M1 versus M3 (p = 0.03); M1 versus M4 (p = 0.046); M2 versus M3 (p = 0.008); M3 versus M4 (p = 0.019).

The Confusion showed an increase in the mean values when compared to the four memories. The moment 1 (2.31 ± 2.38) and moment 4 (3.82 ± 2.17) were observed as being the lowest and the highest mean, respectively, also showed significant differences between moments M1 versus M3 (p = 0.035); M1 versus M4 (p = 0.002); M2 versus M3 (p = 0.004); M2 versus M4 (p = 0.001). The results presented in Table 1, concerning Total Mood Disorder (TMD), are obtained by calculating the results of the BRUMS variables. We can observe an increase in the averages over time, where the lowest value is observed in a moment 1 (105.03 ± 10.42) when compared to the others, moment 3 is the one with the highest DTH of the sample (115, 27 ± 8.93). However, no significant value of variation between moments (p <0.05) was identified.

Figure 1 shows the results regarding the mood state profile of the athletes surveyed, during all four moments chosen. It was observed that only in the M1 the participating athletes had positive "Iceberg profile"
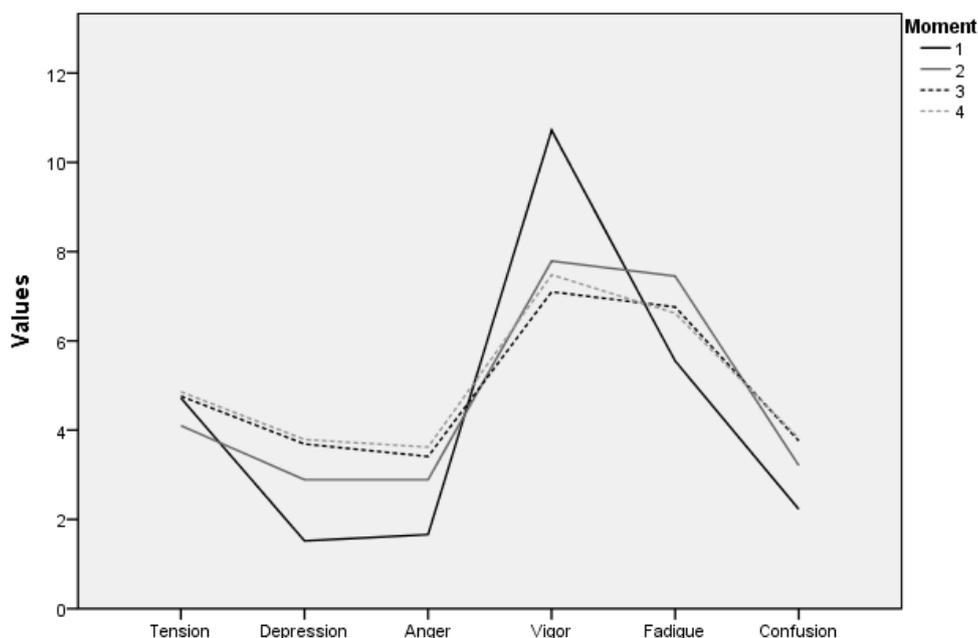

Figure 1 Profile of the mood state of the swimming athletes during the monitoring periods, obtained by means of the variables.

The values presented (Table 1) by the "**Recovery-Stress Questionnaire for Athletes**" (REST-Q) indicates an increase in the level of General Stress moment 1 and moment 4 (1.99 ± 0.72, 2.13 ± 0.90) and Global, moment 1 and moment 3 (2.19 ± 0.70, 2.23 ± 0.8). Besides being to a reduction in the values of General Recovery (3.26 ± 0.83, 3.13 ± 0.91), Specific (3.80 ± 0.99, 3.31 ± 0.97) and Global (3.53 ± 0.85, 3.23 ± 0.83), when we compared the values from moment 1 to moment 3. The results of the variation analysis for REST-Q (Table 1) did not demonstrate statistically significant values for the Specific Stress and Global Stress factors when compared to the samples. However, General Stress presented significance for M2 versus M3 ($p = 0.018$). In the Recovery factors, statistically significant differences were observed in Specific Recovery, M1 versus M2 ($p = 0.034$). M1 versus M3 ($p = 0.027$), M1 versus M4 ($p = 0.034$). For the Global Recovery, statistically significant differences were observed between M1 versus M2 ($p = 0.01$), M1 versus M3 ($p = 0.008$), M1 versus M4 ($p = 0.013$), M2 versus M3 ($p=0,041$); M3 *versus* M4 ($p=0,037$). It can be observed that PSE presented little variation, and that there was no statistical difference in the observed values.

Discussion

The relationship between mood states and sports performance is exposed in the literature. Athletes who are in a state of mood with major changes may not be able to achieve the best sports performance. After the moments of competition, it is expected that the energetic and emotional demands intrinsic to it cause changes in mood states (Lane et al. 2005; Micklewrith, et al., 2005). Physical vigor and fatigue are directly related to energy demands, these being alternating with each other, as proposed by Rohlfs et al. (2008). The vigor is directly linked to the best sports performance (Terry, 1999) and has a direct correlation with the other variables, and this element may alter the other variables (Rohlfs et al 2005).

In general, if the Vigor diminishes too much the fatigue will be rise excessively, which would denote a possible physical and emotional maladjustment (Rohlfs et al, 2004). If the strength is at very low levels, associated with the increase of other variables, the athlete may present symptoms of overtraining (Rohlfs et al 2004) which during a competition can be extremely detrimental to good sports performance. This fact was identified at the four moments of the present study. It was observed that the evaluated athletes presented characteristics of the iceberg profile only at the first moment. In the other moments of investigation it is possible to notice changes in the perception of positive mood states, characterized by a deformation in the profile, which could induce an "inverted iceberg profile", where negative humor states increase while vigor decreases. This result is worrisome because it reveals a propensity to the imbalance between the stressors and the recovery, making the athlete susceptible to overtraining.

Fatigue represents a state of exhaustion, apathy and low energy level, having direct connection with depression and reduced mood and can be due to physical fatigue and sleep disorders (Lane & Terry, 2000). It is expected that there will be a reduction in the values related to this variable after moments of competitions, however when extremely high changes occur it may indicate inadequate training, lack of rest and even poor physical training, or long periods of competition. The literature describes that athletes who perform poorly tend to have higher levels of rabies (Rohlf, et al, 2008). During the monitoring performed in the present study it was observed that the athletes reported a significant increase in the perception of this feeling (anger) in the first two moments evaluated. Change in perception of anger is something that contributes to a reduced state of mood (Lane & Terry, 2000), above all, moderate levels of anger can contribute to the athlete's improved performance, delaying fatigue, sustaining strength and agility, and helping the athlete to focus on the task (Brandt, 2014).

Depression is another factor that showed significant changes only in the first two moments evaluated, but it was still possible to observe that the scores continued to rise in the later moments. This result is relevant, since this factor indicates a depressed mood rather than clinical depression, and represents feelings such as negative self-valorization, emotional isolation, sadness, difficulty in adaptation, depreciation or negative self-image (Rohlfs et al. 2008; Brandt 2011). The results showed that, throughout the training period researched with the approximation of the competitions, the scores of the scales that evaluated the stress and the recovery alternated, having an expressive increase in the stress and a sharp reduction in the recovery. Indicating higher levels of anxiety and stress on the part of the athletes surveyed. Based on this result reveals the importance of monitoring athletes throughout the competitive season.

In the present study at the end of each training session during the four moments, load monitoring was performed through Subjective Perception of Effort (PSE). The results obtained in two moments demonstrate on the part of the athletes a perception of submaximal effort, where the sensation of the task classified as "very difficult" according to the scale proposed by Foster (2001). A reasonable explanation to this result is that the athletes were in final phases of the championships, where possibly was adopted an increase of the training intensity and volume with a goal to potentialize the performing to others tasks. However, it is important to notice the results obtained by the PSE individually, once there could be a variance in the magnitude of the proposed load and the noticed load, so it is possible to detect which athletes are not respond to the stimulus in a proper way. (Nakamura et al., 2010).

Another important factor to be raised is the fact that when there is a change in the mood pattern, or high levels of stress and low recovery, the perceptions are affected, that is, in a moment of reduced intensity the perceived intensity may be higher. Moreover, in a study conducted by Moreira et al. (2010) it was demonstrated

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that the internal training load, measured by the PSE, strongly affects stress tolerance, these results reinforce, therefore, the need to monitor the training process on a regular basis. Based on these characteristics with respect to the results obtained in the study according to Kelmann and Kallus (2001) the bilateral coach-athlete communication emphasizing goals and the real possibilities of the athlete as well as a good job of controlling and monitoring psychological and emotional load and social support could lead this athlete to control all the situational demands demanded during the long periods of training and competitions.

Conclusion

It was observed changes in the state of humor during the accompanied period; it can be observed that before the beginning of the competitions the athletes had a state of humor near the one considered ideal for the best sporting performance. However, it was later observed that athletes presented alterations in their profile. In addition, the results obtained on stress and recovery pointed out that at all times the levels of physical and cognitive demands were high, and the rest was inefficient to maintain the performance, this pattern in turn places the athlete close to injuries and the susceptibility to overtraning.

Conflicts of interest - If the authors have any conflicts of interest to declare.

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