“Organizing for Excellence”
Stress-Recovery States in the Danish National Orienteering Team during a Training Camp and the 2015 World Championship

Astrid Becker-Larsen¹
Kristoffer Henriksen¹
Natalia Stambulova¹,²

¹ Institute of Sport Science and Clinical Biomechanics, University of Southern Denmark ² School of Health and Welfare, Halmstad University

Authors contact: Astrid Becker-Larsen <abecker-larsen@health.sdu.dk>

Abstract
Energy management is a natural part of the life of elite athletes. This is particularly important during periods of high demand on their resources, such as during training camps and competitions, which are often intense and do not allow sufficient time for recovery. In the 2015 World Championships, the Danish national orienteering team was the best nation, winning four gold medals. In the present study we examined: (a) the stress-recovery states of the Danish orienteers during a three-week preparatory training camp and the following 2015 World Championships, and (b) their perceived sources of stress and recovery during the two events. The study was designed as case study with the RESTQ-sport questionnaire, semi-structured interviews, and a coach’s journal as the data sources used longitudinally during the camp and the championships. Results revealed: (a) well-balanced stress-recovery states among all athletes during the entire period; and (b) perceived sources of stress and recovery classified into organizational, social, personal, and athletic. The organizational strategies played a key role in reducing athletes’ unnecessary stress and in facilitating individual recovery. We suggest that “organizing for excellence”, keeping in mind athletes’ energy management, is a special task for coaches and managers when preparing for camps and competitions.

Key words: elite sport, sport psychology, organizational psychology in sport, sources of stress, sources of recovery
Elite athletes push themselves physically and psychologically to their limits in order to develop as athletes and to deliver top performances. To succeed, the athletes must manage their energy. This is particularly important in the periods of high demand on the athletes’ resources (Kellmann, Altenburg, Lormes, & Steinacker, 2001). These include training camps and competitions, because such events are generally intense and likely to induce increased stress, and their schedules often do not allow sufficient time for recovery (Elbe & Kellmann, 2007; Foster, Snyder, & Welsh, 1999). In 2015, the Danish national orienteering coach decided, as a new initiative, to include a three-week training camp in the team’s preparation for the World Championships. The coach was aware that such a long period of intense focus on orienteering would require efficient energy management in the athletes. Therefore, the coach supported the research team in this study aimed at monitoring the athletes’ stress-recovery states during the preparatory camp and the World Championships, with further exploration of the athletes’ perceived sources of stress and recovery during the same period. From a research perspective, the present study is exclusive because of monitoring world-class athlete-participants during their preparation and participation in their most important event. From an applied perspective, searching for efficient processes for energy management during long-term training camps and competitions might become a frontier for improvement of athletes’ preparation and performance.

Stress-Recovery Framework and Research

The study takes as its conceptual framework the scissors-model (Kallus & Kellmann 2000) that describes stress and recovery as two dependent factors. The basic assumption is that increased levels of stress necessitate increased levels of recovery. The model predicts that an athlete can cope with a relatively high level of stress as long as the recovery level is equally high (Kellmann, 2002a). Stress is closely associated with, but not the same as anxiety and arousal. For the present purpose we define stress as a reaction to stressors (Kellmann, 2002b). Athletes are exposed to a wide range of stressors defined as “…factors, affecting people from the outside” (Kellmann, 2002b, p. 5). Depending on the athlete’s appraisal, these may lead to the experience of stress (Kellmann, 2002b). Stressors can be competitive (e.g. preparation, injuries, pressure, under-performing, ex-
STRESS–RECOVERY STATES IN THE DANISH NATIONAL ORIENTEERING TEAM

expectations), organizational (e.g. logistical, leadership), or personal “non-sporting” (e.g. work–life interface and family issues) (Sarkar & Fletcher, 2014). An optimal level of stress can lead to alertness, enhanced motivation and focus, which in turn can improve performance – also defined as eustress (Selye, 1956).

Recovery is defined as “an inter-individual and intra-individual multi-level (e.g. psychological, physiological, social) process in time for the re-establishment of performance abilities. It includes an action-oriented component, and those self-initiated activities that can be used to optimise situational conditions and to build up and refill personal resources to be ready to perform” (Kellmann & Kallus, 2001, p. 22). Recovery is thus a process over time, that not only eliminates stress, but also restores physical and psychological resources (Elbe & Kellmann, 2007). Sources of recovery include physiological (nutrition, sleep), psychological (relaxation techniques), behavioural (leisure activities) and social (having fun with friends) (Elbe & Kellmann, 2007; Kallus & Kellmann, 2000), which indicate that recovery is more than just resting (Elbe & Kellmann, 2007; Kallus & Kellmann, 2000). Recovery research has to date mainly focused on individual physical strategies, such as stretching, massage, and cold water immersion (for a review see: Bishop, Jones, & Woods, 2008). Sport psychology research has broadened the scope to include psychological recovery activities, such as self-regulation (Beckmann & Kellmann, 2004), mindfulness (Gustafsson, Skoog, Davis, Kenttä, & Haberl, 2015) and resilience (Sarkar & Fletcher, 2014), but still primarily from an individual perspective. Gustafsson, Holmberg, and Hassmén (2008) underline the organizational aspects of stress and recovery by showing how a sports psychologist, coach, exercise physiologist and a physician (also defined as a multidisciplinary support team), helped an endurance athlete in his recovery process. A multidisciplinary support team has potential for more comprehensive service, but on the other hand, there is also a risk of communication and role conflicts, which can lead to confusion and stress among the athletes (Reid, Steward, & Thorne, 2004). Despite this, the increased recognition of the role of the environment in sports performance and development (Henriksen, 2015; Henriksen & Stambulova, 2017; Henriksen, Stambulova, & Roessler, 2010) has not yet taken root in the stress and recovery research. Although research (Fletcher & Hanton, 2003; Fletcher & Wagstaff, 2009) advocates that sport organizations at an elite level need to pay careful atten-
tion to the environment within which their performers are operating, little is still known about the environment’s role in recovery.

The athletes’ stress and recovery state indicates “the extent to which someone is physically or psychologically stressed, as well as whether or not the person is capable of using individual strategies for recovery” (Kellmann & Kallus, 2001, p. 1). The stress-recovery state has important consequences for the athletes. In the short-term perspective, it relates to performance. Optimal performance most likely happens when the athlete has an intermediate level of stress and a corresponding level of recovery (Kellmann & Kallus, 2001). The interrelations between stress-recovery state and sports performance have been demonstrated in rowing (Kellmann & Guenther, 2000; Mäestu, Jürimäe, Kreegipuu, & Jürimäe, 2006; Purge, Jürimäe, & Jürimäe, 2005), cycling (Otter, Brink, van der Does, & Lemmink, 2015) and track-and-field athletes (Kalda, Jurimae, & Jurimae, 2004). This research has revealed that stress and recovery scores fluctuate greatly throughout a competitive season (Elbe & Kellmann, 2007), with higher levels of fatigue and lack of energy at the end of a competitive cycle (Di Fronso, Nakamura, Bortoli, Robazza, & Bertollo, 2013; Elbe & Kellmann, 2007; Filho et al., 2013; King, Clark, & Kellmann, 2010). Research on tapering also shows, that the final period of training before a major competition is of paramount importance. Reducing physiological and psychological stress in this period is a prerequisite for peak performances (Mujika & Padilla, 2003).

In the long-term perspective, research has shown that inadequate recovery (also termed under-recovery) can have consequences such as mental fatigue, increased risk of injury, and changes in mood and motivation (Gustafsson, Hassmén, Kenttä, & Johansson, 2008; Gustafsson, Kenttä, & Hassmén, 2011; Gustafsson, Kenttä, Hassmén, & Lundqvist, 2007), and even burnout (Elbe & Kellmann, 2007; Kellmann, 2002b). Although world-class athletes are the most vulnerable to experiencing high stress, there is a lack of relevant studies involving elite performers during their important training camps and competitions (Kellmann, 2010; Otter et al., 2015). The present study is an attempt to add to this lacking knowledge.
The Danish National Orienteering Team as a Study Case

The sport in focus for the present study is orienteering. Orienteering is a worldwide sport with more than forty countries competing at the 2015 World Championships. The orienteers compete in three individual distances (long distance, middle distance and sprint), two middle distance relays (for men and women) and a sprint relay (for teams of two men and two women). The orienteers run an unknown course in unknown terrain by visiting a number of checkpoints in a predetermined order, with the help of map and compass. The orienteers must navigate and make quick decisions while running at high speed.

The Danish orienteering national team has improved their world rankings in recent years. The 2015 season was no exception in the constant search for improvement. The head coach planned a three-week preparatory training camp (hereinafter “the camp”) leading up to the 2015 World Championships (hereinafter “the championships”). For the camp, the head coach selected an accommodation place with a lot of space and a communal room, designed a programme that included time for recovery activities, and organized communal cooking and social activities. He also invited the team sport psychologist and physiotherapist. It is further worth mentioning that the team has undertaken a sport psychology intervention focused on creating a supportive team culture (Henriksen, 2015). The team had a historically successful 2015 championships, winning four out of nine gold medals and claiming the title as the best nation.

In this study, we have examined: (a) the dynamics of stress-recovery states of the Danish orienteers during a three-week preparatory training camp and the following 2015 World Championships, and (b) their perceived sources of stress and recovery during the camp and the championships.

Method

Design

The study is grounded in a post-positivist paradigm, acknowledging that the researchers’ personal and theoretical backgrounds affect the results
but aiming for objectivity by reducing bias. We selected a case study design because this design is suitable for investigating real life phenomena in their real-life context (Hodge & Sharp, 2017). We investigated a national team in their real preparation for the important championships. The case study further investigates bounded phenomena, which in the present case meant studying a bounded group in a delineated location and timeframe. Finally, case studies use multiple sources of evidence (Hodge & Sharp, 2017). We collected data longitudinally using three connected sources of information, including a questionnaire, semi-structured interviews and the head coach’s journal. Each of the three sources of data had specific advantages that, when used together, maximized the potential for in-depth insight and completeness of the case presentation. An overview of the span of the data collection process is presented in Figure 1.

![Figure 1. An overview of the times for data collection](image)

**Participants**

To select the case for this study, we paid attention to the level of the team (elite, world-class), their travelling and living in a camp before the big competitions, and that there was an opportunity for the research group to collect the data during the camp and the competition. The Danish national orienteering team met these criteria. The team consisted of 12 orienteers (five women and seven men; aged 21-29, mean age = 25 years). The team was used to travelling, but this was their first training camp of more than 7-8 days. The camp and championships both took place in Scotland in the summer of 2015.
Instruments

The Recovery–Stress Questionnaire for Athletes (RESTQ-sport) was used to quantitatively monitor the athletes’ stress and recovery. The RESTQ consists of 76 items, on which the athlete indicates how often within the last 3 days he or she has experienced stress symptoms and engaged in recovery activities. Examples of items are: “In the past 3 days/nights I fell asleep satisfied and relaxed” (for the Sleep Quality scale), and “In the past 3 days/nights I was in a bad mood” (for the Emotional Stress scale). Each item is rated according to its frequency on a seven-point Likert scale, ranging from 0 (never) to 6 (always). The 76 items are computed in 4 super-scales and 19 subscales (see Table 1). The mean of each scale indicates the athlete’s subjective stress-related strain and recovery state respectively. We used the translated Danish version, with internal consistencies and reliability reported with Cronbach’s alpha 0.67–0.89 (Elbe, 2008).

Table 1. **Super-scales and sub-scales of the RESTQ (Kellmann & Kallus, 2001)**

<table>
<thead>
<tr>
<th>Super-scales</th>
<th>General stress</th>
<th>General recovery</th>
<th>Sport-specific stress</th>
<th>Sport-specific recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-scales</td>
<td>General stress</td>
<td>Success</td>
<td>Disturbed breaks</td>
<td>Being in shape</td>
</tr>
<tr>
<td></td>
<td>Emotional stress</td>
<td>Social recovery</td>
<td>Emotional exhaustion</td>
<td>Personal accomplishment</td>
</tr>
<tr>
<td></td>
<td>Social stress</td>
<td>Physical recovery</td>
<td>Injury</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td></td>
<td>Conflicts/Pressure</td>
<td>General well-being</td>
<td>Sleep quality</td>
<td>Self-regulation</td>
</tr>
<tr>
<td></td>
<td>Fatigue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical complaints</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the qualitative part, a semi-structured interview guide (Kvale & Brinkmann, 2009) with four major parts was used. Firstly, the athletes were asked to describe a normal weekday during the event and compare this day to a day at home (e.g. training volume, rest, food, sleep, social activities, education or work). The second and third parts included questions about sources of stress and recovery. The interviewer used “a battery” as a metaphor and asked the athletes “what drains your battery?” and “what recharges your battery?” Fourthly, the athletes were encouraged to describe how they experienced the stress-recovery states during the camp and the championships, and how these states influenced their well-being and performance.
As a third data collection strategy, we asked the head coach to fill in a daily journal. The journal had two parts. In the first part, he evaluated each day in terms of the training/competition strain on a scale from one (a light recovery day with no training or light training) to four (a day with long or hard training or a competition). In the second part, he noted any other factors he believed could influence an athlete’s stress-recovery state (e.g. long transportation, sudden changes in the schedule).

Procedure

After selection of the team, we gained acceptance from the athletes and coaches. It was agreed that the identity of the team could be disclosed, but names of individuals would be kept confidential. The participants were informed about the objectives and benefits of the study and that they were free to withdraw at any point without prejudice.

The athletes completed the RESTQ-sport two days before departure to the events and every third day during the events through an online survey tool. In the morning, the athletes received an e-mail with a link to the survey, an instruction to fill in the questionnaire at their convenience, and information that it would take 15-20 minutes. If an athlete had not completed the questionnaire by dinnertime, the principal researcher sent a reminder to the athlete and the coach. Except for two athletes on two different occasions, all athletes completed all 11 measurements.

For the interviews, we first wanted to select three athletes based on their RESTQ profiles: one with a poor, an average and a good stress-recovery state. However, the athletes scored very alike. Therefore, we selected informants who were available, based on the pragmatic approach of minimal disturbance. Three athletes were interviewed both during the camp and again between the camp and the championships. After the championships, three other athletes were interviewed, because the original interviewees had gone on holiday directly after the competition. In total, we conducted nine interviews with six different athletes. To disturb the athletes as little as possible, the accompanying sport psychologist and second author of this paper conducted the interviews during the camp, whereas the first author conducted the interviews at home (before and after the championships). The interviews lasted between 40 and 70 minutes. The coach filled in the journal every day during the camp and the championships.
**Data Analysis**

Firstly, we constructed individual RESTQ profiles for all the athletes (Kellmann, 2010), showing the dynamics of the data on the 19 RESTQ scales over time. Secondly, we calculated average scores for the two total scales (total stress and total recovery), the four super scales (general stress, general recovery, sport-specific stress, sport-specific recovery) and all 19 scales. The average values for total stress and total recovery during the camp were compared to the similar values for the championships. We used a paired t-test (including the mean and 95% confidence interval) to determine if any significant differences existed between the camp and the championships. The statistical significance was set at $p < 0.05$.

To strengthen the validity and rigor of the study considering that the first and second author both conducted interviews, the first and second authors designed the interview guide in collaboration. To get acquainted with the first interviewer’s style of questioning, the second interviewer further transcribed the first set of interviews prior to interviewing. All interviews were transcribed verbatim. We used Braun, Clarke, and Weate’s (2017) six steps of thematic analysis to analyse the data. First, we became intimately familiar with the content by reading and rereading all data items and making notes as something grabbed us. Second, we coded the data using a deductive-inductive approach. The initial deductive coding focused on overall themes (everyday life at the event, sources of stress, sources of recovery, and stress-recovery balance). The inductive coding guided the content of these overall themes. Third, we organized and clustered the inductively derived codes into “higher-level” patterns such as “organizational”, “social”, “personal” and “athletic” sources of stress and recovery. Fourth, we reviewed and refined those themes by discussing their subthemes. Fifth, we read the subthemes again to define their scope and at the same time condensed the informants’ statements into more precise formulations. As a sixth and final step, we situated the data analysis within the overall paper by considering the balance between data extracts and the analytic commentary. Data was analysed in close cooperation between the first and second authors, and the results were subsequently discussed with the third author. The coach’s journal data provided additional insights into the sources of stress and recovery for the athletes but also provided a schematic overview of the content of the days, and was used to bring perspectives to both the quantitative and qualitative athletes’ data analyses and interpretation.
Results

The runners’ stress-recovery states will be presented based on data from the RESTQs and interviews. Key sources of stress and recovery are based on the interviews and the coach’s journal.

Stress-Recovery States during the Camp and the Championships

Table 2 shows the mean (±SD) scores of the RESTQ for the 11 measurement points during the camp and the championships. The results show low scores for stress, and high scores for recovery among all runners. The means of general stress are between 0.93-1.44 and the means of the general recovery are between 2.77-3.15. The means of sport-specific stress are between 1.08-1.65 and the means of the sport-specific recovery are between 2.64-3.35. The inter-individual comparisons of RESTQ profiles didn’t show large individual variations. Overall, these findings suggest that the runners experienced well-balanced stress-recovery states during the period of monitoring.

Table 2  Scores in different scales of RESTQ corresponding to the 11 measures during the training camp (TC) and championship (CH)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Day -2 Pre TC</th>
<th>Day 2 TC</th>
<th>Day 6 TC</th>
<th>Day 10 TC</th>
<th>Day 14 TC</th>
<th>Day 18 TC</th>
<th>Day 22 TC</th>
<th>Day 31 Pre CH</th>
<th>Day 2 CH</th>
<th>Day 6 CH</th>
<th>Day 10 CH</th>
</tr>
</thead>
<tbody>
<tr>
<td>General stress</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
</tr>
<tr>
<td>1.34 (±0.51)</td>
<td>1.16 (±0.47)</td>
<td>1.10 (±0.31)</td>
<td>1.36 (±0.62)</td>
<td>1.21 (±0.41)</td>
<td>1.21 (±0.43)</td>
<td>1.19 (±0.53)</td>
<td>1.05 (±0.44)</td>
<td>0.93 (±0.40)</td>
<td>1.40 (±0.63)</td>
<td>1.44 (±0.85)</td>
<td></td>
</tr>
<tr>
<td>General recovery</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
</tr>
<tr>
<td>3.15 (±0.68)</td>
<td>2.80 (±0.64)</td>
<td>3.05 (±0.26)</td>
<td>2.90 (±0.46)</td>
<td>3.00 (±0.41)</td>
<td>2.77 (±0.41)</td>
<td>2.96 (±0.68)</td>
<td>2.84 (±0.41)</td>
<td>3.02 (±0.41)</td>
<td>2.81 (±0.50)</td>
<td>2.79 (±0.76)</td>
<td></td>
</tr>
<tr>
<td>Sport-specific stress</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
</tr>
<tr>
<td>1.58 (±0.73)</td>
<td>1.57 (±0.61)</td>
<td>1.65 (±0.48)</td>
<td>1.33 (±0.59)</td>
<td>1.41 (±0.57)</td>
<td>1.44 (±0.55)</td>
<td>1.27 (±0.66)</td>
<td>1.24 (±0.59)</td>
<td>1.08 (±0.47)</td>
<td>1.52 (±0.73)</td>
<td>1.49 (±0.79)</td>
<td></td>
</tr>
<tr>
<td>Sport-specific recovery</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
<td>Mean (±SD)</td>
</tr>
<tr>
<td>2.64 (±0.71)</td>
<td>2.89 (±0.78)</td>
<td>3.03 (±0.67)</td>
<td>3.10 (±0.68)</td>
<td>3.06 (±0.60)</td>
<td>3.06 (±0.76)</td>
<td>2.98 (±0.98)</td>
<td>2.70 (±0.92)</td>
<td>3.14 (±0.73)</td>
<td>3.35 (±0.67)</td>
<td>2.77 (±1.08)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 shows the dynamics in the total stress and recovery scores over time. There are no significant dynamics. The individual profiles show the same pattern, and thus the total scores reflect a homogenous dynamic within the group.

A paired t-test was applied to determine whether there was a statistically-significant difference between the camp and the competition. The
runners’ total stress states were low, both during the camp, mean: 1.33 (95% CI, 1.08 to 1.58), and the championships, mean: 1.28 (95% CI, 0.96 to 1.59), and a p-value of p = 0.50 confirms that there is no statistically-significant difference. The same was true for total recovery. The runners’ total recovery was high both during the camp, mean: 2.97 (95% CI, 2.75 to 3.20), and the championships, mean: 2.94 (95% CI, 2.58 to 3.32), and a p-value of p = 0.81 signifies no statistically-significant difference. In sum, the results from the RESTQ show low stress and high recovery levels among all runners, no notable dynamics over time and no significant differences in stress and recovery levels between the camp and the championships.

The interview data provided good support to the RESTQ data, but also more nuanced descriptions of the runners’ stress-recovery states. The runners generally described well-balanced stress-recovery states during both the camp and the championships and a surplus of physical and mental energy. In between the camp and the championships, the runners indicated that they were adequately recovered and felt ready, as described by Helen: “Overall I would say that I’ve gained more energy than has been drained. I feel that there was a good balance. I did not feel that I had a deficit of energy – rather I had a surplus”. During the championships, the runners indicated that they succeeded in managing their energy. As an example, Max participated in four competitions, which was demanding for him and required energy and focus, but after the championships he reflected on his ability to recover quickly: “I managed the balance between relaxing and setting myself up for the next competition very well. There was no time when I did not feel ready, or when I needed a break, but had to run.” Although the runners experienced balanced stress-recovery states, they felt physically and mentally exhausted after...
the championships, as described by Sophie: “I was really happy with my performance, but I also felt fatigued. I could not have competed again right away, psyched up and focused. I just wanted to run for the joy of it. My body was tired.”

The positive balance of stress and recovery had positive consequences in terms of well-being, mood, and performance. During the training camp, Helen described that her well-balanced state was important for her preparation:

A good balance has a positive impact on my preparation for the world championships. Not feeling stressed allows me to take time to think about more than just my training. I have time for mental training and to really understand what I must improve, and prioritise my efforts. And that’s how I improve.

**Perceived Sources of Stress and Recovery**

Table 3 presents major themes representing sources of stress and recovery as described by the runners. As a result of the analysis, we divided the sources of stress and recovery into four categories: organizational, social, personal, and athletic.

<table>
<thead>
<tr>
<th>Sources of stress</th>
<th>Organizational</th>
<th>Social</th>
<th>Personal</th>
<th>Athletic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy schedule</td>
<td>Too much social interaction</td>
<td>Monotony and boredom</td>
<td>Under-performing in training or competition</td>
<td></td>
</tr>
<tr>
<td>Long transport to training or competition</td>
<td>Team-mates’ negative moods</td>
<td>Post-performance activities and thoughts</td>
<td>Waiting time in the pre-start area</td>
<td></td>
</tr>
<tr>
<td>Missing close friends and relatives</td>
<td>Practtical thoughts about the everyday at home</td>
<td>Personal performance expectations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sources of recovery</th>
<th>Organizational</th>
<th>Social</th>
<th>Personal</th>
<th>Athletic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacious accommodation with a communal room</td>
<td>Social activities with team-mates</td>
<td>Time alone</td>
<td>Success in sport</td>
<td></td>
</tr>
<tr>
<td>Well-structured programme</td>
<td>Personal conversations with a close team-mate</td>
<td>Having settled practical matters outside the sport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear focus on orienteering</td>
<td>Recognition from and recognizing team-mates</td>
<td>Clear answer to “why I am here?”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversations with the sport psychologist</td>
<td>Time alone</td>
<td>Having settled practical matters outside the sport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time alone</td>
<td>Clear answer to “why I am here?”</td>
<td>Success in sport</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Organizational sources of stress and recovery

*Organizational sources of stress* refer to the context, environment or the set-up as experienced by the runners. The camp and the championships were both organized with a set programme and fixed routines, such as regular times for meals, training, recovery, meetings and sleeping. In short meetings every evening, the coaches informed about practical matters and the programme for the following day. The meetings provided an overview and opportunities for questions. Some days were more packed than the others, and the runners described days with a *busy schedule* as more stressful. In the words of Oliver: “It is not the activities in themselves. They are all good and relevant. But too many activities in one day can draw on my battery”. Most days, the runners had *long transportation to training or competition*. In orienteering, seeking the most relevant terrain for training is important. The runners described that driving took up a significant part of their free time (often two to three hours each day), and that it was difficult to relax in a car. This was also clear from the coach’s journal. Especially during the championships, he made many notes on transportation, for example “driving 2 x 1.5 hours plus 2 x 1.15 hours. It ended up being a tough day with much driving and another late supper.”

*Organizational sources of recovery* refer to characteristics of the performance context that helped the runners to recover. These mainly include initiatives and decisions taken by coaches and managers. Overall, the runners described how decisions on the organizational level turned out to be crucial to their recovery. The coaches had booked *spacious accommodation with a communal room*. This was important, because it allowed room for both social and individual recovery activities. The *well-structured programme* was highlighted because the fixed routines gave the runners a sense of everyday rhythm and predictability, as Helen explained during the camp:

> It is valuable for me to know when to be focused and when to relax and breathe. I think the coaches have been exemplary on this trip in terms of thinking through the programme. They have planned the trip with a tight structure, but they have also clearly highlighted breaks and rest days in the programme, where I can do what I want.

The programme was planned with variation in training load and focus, and included a day off and a change of roommate every week. The runners were allowed to use a car when they wanted to go for short trips on their own or in small groups.
The programme was organized with a clear focus on orienteering. The coaches had made an effort before the camp to make sure all runners could focus on their training and performance. For example, no runners had exams or other obligations outside the sport during the camp and the championships. Between the camp and the championships, Emily describes how important the single focus was for her recovery: “My recovery has been excellent at training camp, because all that ‘outside-something’ has been taken away. Unlike my expectation, my recovery has been much better than I think it might have been at home.”

The team sport psychologist participated in part of the camp and in the entire championships. Several runners highlight the importance of conversations with the sport psychologist as a recovery strategy. Such conversations allowed them to talk freely, discuss their concerns, evaluate their runs, and prepare for competition. Sophie provided an example: “The night before the final, I was nervous and talked to the psych. We made a 10–15 minutes stress relief exercise, and then we talked through some scenarios planning how to tackle adversity. Afterwards I felt relaxed and well prepared.” Sophie described this as a recovery strategy because it did not only help her relax. The talk provide her with perspective, clarity and accept of her emotions. She emphasized that this helped her reduce unnecessary stress and charge her batteries.

Social sources of stress and recovery

Social sources of stress refer to the runners’ relationships with other persons (in and outside the sport) that drain their resources. A few runners described that too much social interaction was demanding. These runners would occasionally drive to a café nearby, when they needed a breathing space away from the other runners. Others mentioned a few cases of being influenced by team-mates’ negative mood. Between the camp and the competition, Helen said: “I experienced a few times that another runner’s mood was not good. There was no reason why it should affect the rest of the team, but it did a little”. The duration of the camp was longer than they had experienced before, and missing close friends and relatives was seen as draining.

Social sources of recovery refer to social relationships with other people (in and outside the sport) that facilitated recovery. The runners highlighted that social activities with team-mates such as board games, crossword puzzles, chats, and laughs were crucial for their recovery. As Daniel described after the championships, “It really lifts me up. It affirms my
belief in the team that we can have fun together. Feeling a part of the team gives me energy.” The runners described that personal conversations with a close team-mate also promoted their recovery both during the camp and the championships. These conversations could be about training, expectations or worries about the competition, or they could be about life outside the sport. Another social source of recovery was recognition from and recognizing team-mates. As a team tradition, every second evening meeting contained the “positive story of the day”. The rules were simple: a team-mate must speak directly to another team-mate about something good that he or she did during the last days, and describe how the action was an extension of one of the teams’ values. Helen described after the camp what that meant to her: “It is nice to tell a story because you praise your team-mates openly. And of course, I am proud when someone gives me a story. We all look forward to this. It really boosts team spirit”.

Personal sources of stress and recovery

Personal sources of stress describe personal events or experiences (in and outside of sport) that drain the runners’ resources. The experience of monotony and boredom is expressed both during the camp and the championships. One runner described boredom in connection with an inability to train due to injury, another as the waiting time before the competition, and a third in relation to the days after his last competition. They all describe it as a “waiting-mood”, which comes with restlessness and difficulty to relax. The runners describe that post-performance activities and thoughts were often hectic and demanding. After a competition, they had to do de-training activities, eat and drink recovery nutrition, change clothes, talk with friends, line up for photographs, and talk to the media. Max described a situation just after a successful run at the championships: “I trembled for several hours afterwards. It was hard to relax. It was a huge release, but I also knew that I had another race the next day and needed to relax, get proper sleep and these things.”

Thoughts were very different after an unsatisfactory performance. The runners’ minds were flooded with evaluative thoughts about what they could have done differently and why they did not succeed. Towards the very end of the camp, a few runners had practical thoughts about everyday life at home. These included practical concerns about returning home, and re-establishing connections with family, friends and education, while simultaneously preparing for the championships. All runners described that personal performance expectations for training and competition were
stressful and provided a fertile soil for negative thoughts and feelings in the face of minor setbacks. An example from the coach’s journal during the championships was: “Very high mental pressure. Favourites. Much anxiety to be sensed during the day.” However, the ambitious goals were also described as drivers and motivators.

*Personal sources of recovery* were personal events or experiences (in and outside the sport) that gave the runners energy. All the runners highlighted having *time alone* was crucial for their recovery. Such time was used for reading, painting, watching sport or movies, playing computer games, surfing the internet, listening to music, or just relaxing. As a pre-condition for this relaxation, the runners had settled *practical matters outside the sport* before the camp and the championships, so they would not steal their attention during the events. As Emily said, “I have cleared my desk and now I just have to be here.” Another personal source of recovery was a *clear answer to “why am I here?”* Through conversations with the coaches, all runners knew what was expected of them. Several runners had also discussed sport and life values with the sport psychologist. The sense of personal meaning and knowing why they were there helped the runners to focus, and to accept nervousness and disappointments.

**Athletic sources of stress and recovery**

As a last category, the runners highlighted several sources of stress specifically related to training or competition situations. All runners described that *under-performing in training or competition* was a source of stress. This led to negative thoughts and stressful feelings. As Emily said, “It really drained my resources when I had a bad training. It became an inner dialogue about why can’t you manage this, and a lot self-recrimination.” *Waiting time in the pre-start area* was also highlighted as a source of stress. The pre-start area is a quarantine zone with no communication to the outside, where the runners wait two to three hours before their run starts. Particularly the younger runners describe the waiting as a breeding ground for nervousness and all runners found it stressful in bad weather conditions. Correspondingly, *success in sport* (a good result or a successful training) gave the runners a confidence boost and recharged their batteries. As Daniel described: “The atmosphere during the world championships was ecstatic. The continuous success of my teammates gave me so much energy, that I almost forgot my own poor performance.”
Discussion

The study showed well-balanced stress-recovery states among the Danish national team orienteers during a three-week training camp and the following world championships. This was somewhat surprising. Existing research has suggested that increased stress levels and decreased recovery levels are to be expected during training camps and important competitions, because such events are characterized by an increase in training load, insufficient privacy, unaccustomed surroundings, and pressure to perform (Elbe & Kellmann, 2007; Foster et al., 1999; Kellmann & Guenther, 2000). For example, Mäestu et al. (2006) found increased stress levels in a period of high training load in elite rowers, and King et al. (2010) found increases in social stress and fatigue over a five-week rugby competition for amateur players, who also had to deal with other life requirements (education, work etc.). In a multi-stage cycling event, stress and recovery levels similarly changed over the course of the event (Filho et al., 2013). A number of factors may help us understand why this did not happen for the Danish runners.

The team of coaches planned and organized the camp in a manner that reduced unnecessary stress and allowed the runners good opportunities for recovery. Firstly, the coach prioritised accommodation with a lot of space and a communal room, which made it easy for the runners to balance between being alone (in the private room) and being social (in the communal room). The communal room invited social activities and opportunities for personal conversations between the runners, both of which are described as sources of recovery by the runners. Secondly, when planning the programme, the coaches took into consideration the runners’ stress-recovery states. The programme scheduled time for recovery every day, varied in training load and focus, and contained a weekly day off. Thirdly, the coaches organized the camp environment to balance freedom and community. The coaches planned a number of communal activities such as games and trips, but on the other hand, the runners were allowed to use a car when they wanted to go for short trips on their own or in small groups. The runners changed roommate every week. These initiatives reduced monotony and boredom among the runners. Fourthly, during a long-term sport psychology intervention (Henriksen, 2015), the team had formulated team values to create a supportive team culture. To maintain this culture, the runners engaged in activities such as “the positive story of the day”, which they highlighted as meaningful.
communication contributing to a good team atmosphere. Finally, the coaches arranged for a physiotherapist (who provided physical recovery strategies, such as massage) and a sport psychologist (who provided mental recovery strategies such as individual talks and relaxation programmes) to support the team during the camp and the championships.

Previous research has suggested that the stress-recovery states influence sports performance (Kalda et al., 2004; Kallus & Kellmann, 2000; Purge et al., 2005). A well-balanced stress-recovery state with perceived low stress and high recovery is described as an optimal performance state (Kallus & Kellmann, 2000). This has been demonstrated for track-and-field athletes (Kalda et al., 2004) and rowers (Purge et al., 2005) in competition, and for cyclists over an entire athletic year (Otter et al., 2015). The Danish orienteering national team had a successful championships, winning four out of nine gold medals. Although we can't directly link the runners' stress-recovery states to their results, we still contend that the study provides some support to the general notion that stress-recovery balance affects performance.

However, the runners' stress levels in the present study were low, but not non-existent. This points to an important note of caution. Stress must not be seen as entirely negative. Although Kellmann (2002a) acknowledged the existence of positive responses to stress, the majority of stress research focuses almost exclusively on negative responses. A certain level of stress is needed for optimal performance (Kallus & Kellmann, 2000). The runners in the present study describe a positive response to stress in relation to personal performance expectations. In these situations, they describe stress as a driver that strengthens their focus, preparation, and motivation, which can relate to Selye (1956) term “eustress”. While long-term stress and inadequate recovery can lead to over-training, under-performances and mental fatigue, it is not the stress in itself that is problematic, but the fact that the condition is long-term (Kellmann & Guenther, 2000). The goal is not to avoid stress altogether, but to minimise unnecessary negative stress and to regulate stress to an individual athlete’s optimal level.

The second objective of the study was to identify sources of stress and recovery experienced by the runners. Existing studies have mainly treated stress as an individual affair and highlighted individual stressors such as high training load, emotional stress, and fatigue (Di Fronso et al., 2013). One notable exception is research on organizational stress (Sarkar & Fletcher, 2014), highlighting that a significant portion of athletes’
stress comes from organizational sources (e.g. leadership, cultural and logistical issues) and non-sport life events. The same tendency is visible when it comes to recovery, which has also been researched mainly as an individual affair (Beckmann & Kellmann, 2004; Gustafsson et al., 2015). The main research focus has been on physiological recovery strategies such as stretching, massage, compression, cold water immersion (Bishop et al., 2008), but research has also highlighted individual psychological strategies, such as self-regulation (Beckmann & Kellmann, 2004), mindfulness (Gustafsson et al., 2015) and resilience (Sarkar & Fletcher, 2014).

In the present study, we found that sources of stress and recovery could be classified into organizational, social, personal and athletic. Indeed, purely athletic sources of stress and recovery were “in a minority” compared to the others. This confirms that a whole person’s and a whole organization’s approaches are important, not only in talent and career development (Henriksen et al., 2010; Stambulova, Alfermann, Statler, & Côté, 2009), but also in athletes’ energy management. In fact, organizational sources of stress and recovery were dominant in this process. In terms of stress, the runners highlighted that a number of organizational-level decisions (e.g. housing, training programmes) reduced unnecessary stress. This supports that coaches and sport science teams can help in monitoring training and recovery in practical settings, allowing detection of early signs of overreaching before more serious symptoms develop (Gustafsson, Holmberg, et al., 2008). But to succeed in delivering a comprehensive service, and avoid overlap in the professions of the different experts involved in the multidisciplinary team, the roles of the sport science support team must be clarified from the outset (Gustafsson, Holmberg, et al., 2008; Reid et al., 2004).

A key finding of the study is that organizational-level decisions influenced the athletes’ recovery by reducing unnecessary stress and providing room and support for the athletes to engage in recovery strategies. Elbe and Kellmann (2007) pointed out that recovery is specific to the individual and depends on individual appraisals, and the definition of recovery provided by Kellmann and Kallus (2001) emphasizes “self-initiated activities”. The present study suggests that the organization of a camp or competition impacts the athletes’ recovery. Including time for recovery in the programme, choosing a living space with room for social engagement as well as time alone, helping the athletes to solve all practical matters (school and work obligations) before the camp, having cars available etc., allowed the athletes to engage in their preferred
recovery activities. If stress and recovery are seen as entirely individual issues, coaches and managers may fail to see their role in providing optimal conditions for the athletes to avoid stress and engage in recovery. These ideas are supported by research highlighting the significant role of the overall environment and organizational culture in athlete development and performance (Fletcher & Hanton, 2003; Fletcher & Wagstaff, 2009; Henriksen, 2015; Henriksen & Stambulova, 2017). Recovery is truly multi-level, as suggested by Kellmann and Kallus (2001). The present study thus suggests that sport organizations do well to pay careful attention to the performance environment during training camps and competitions.

Applied Perspectives

Based on the current study we recommend an increased focus on “organizing for excellence”. In the present context this means organizing camps and competitions to reduce unnecessary negative stress and to allow athletes and coaches to optimally engage in their preferred recovery strategies. Organizing for excellence must be tailored to the individual sport and team, but coaches and managers are advised to consider: living facilities that allow athletes to find their individual balance between social interactions and time alone, a programme that schedules recovery, common activities, and the inclusion of a sport psychologist and a sport physiotherapist. We recommend monitoring athletes’ stress and recovery state during camps or competition to allow early detection and intervention. This monitoring could include the RESTQ-sport. However, in the present study we found that qualitative interviews picked up stressors and stress-states that the questionnaire did not. We therefore suggest including interviews. Further, monitoring the athletes’ mood states could provide a useful addition (Berglund & Säfström, 1994; Kenttä, Hassmén, & Raglin S., 2006).

Methodological Reflections

Whereas most of the research conducted on stress and recovery has been based on a combination of RESTQ and physical measurements, the present case study used multiple data sources including semi-structured interviews and the head coach’s journal. These methods turned out to
be important for understanding the results obtained through the questionnaire and providing perspectives to the results. The questionnaire, interviews, and the coach’s journal complemented each other to give a fuller and more detailed picture of stress and recovery among elite athletes during the long-term training camp and competition. Researcher and method triangulation strengthened the credibility of the findings (Houghton, Casey, Shaw, & Murphy, 2013).

Three limitations of the study are worth mentioning. Firstly, the head coach was informed about the study long before the training camp and the competition. This may have influenced his awareness of recovery and affected the organizational decisions, which he made in the planning of the camp and the competition. His daily answer in the coach’s journal can likewise have increased his awareness. Secondly, we always need to look at self-report measures with due scepticism, particularly in cases where athletes might be worried about the consequences of not reporting “desirable” results. In the present study, the coaches and sport psychologist were involved in the study and the athletes may have wanted to portray an optimal balance to the coach. While this is always a risk, in the present context we find it to be less likely, since there was no team selection and the athletes knew beforehand what races they were going to compete in. Such methodological issues are probably hard to avoid when aiming to examine elite level athletes.

Finally, there has been criticism regarding the validity of the RESTQ-sport. A validation study (Davis, Orzeck, & Keelan, 2007) confirmed the two factor structure for some, but not all overall scales and did not find support for the 19 subscales. The authors conclude that while the test measures training stress and can be used to plan recovery, the test should not be used as a diagnostic tool. The athletes in the present study found the questionnaire quite time consuming, which supports previously voiced arguments, that a shorter instrument is needed for use in high performance sport settings (Kölling et al., 2015; Meeusen et al., 2013).

Conclusion

The present study tracked stress-recovery states longitudinally among the Danish national orienteering athletes during the three-week training camp and the World Championships. The athletes themselves stated that their well-balanced stress-recovery states positively affected their
learning, well-being, and performance. The athletes’ perceived sources of stress and recovery were classified into organizational, social, personal and athletic, with the organizational decisions and strategies playing a major role in the optimisation of individual recovery. These results lead us to suggest “organizing for excellence” to be a special task for coaches and managers when preparing training camps and participation in big competitions.

Funding

The study was financed by the Team Denmark research council in 2014.

Acknowledgement

The authors would like to thank the athletes and coaches for their participation. Also thanks to Eleanor Boyle for help with the statistical data analysis.

References


Davis, H., Orzeck, T., & Keelan, P. (2007). Psychometric item evaluations of the recovery-stress questionnaire for athletes. Psychology of Sport & Exercise, 8(6), 917-938.


