Chapter 4

A Psychological Approach toward Understanding and Preventing the Overtraining Syndrome

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Athletes use every resource available in the effort to push themselves to ever higher levels of performance. These improvements are the consequence of factors ranging from innovative equipment to the application of research findings from sport science disciplines such as nutrition, hydration, and biomechanics. Advances in the treatment and rehabilitation of injury have also allowed athletes to continue participating at high levels with injuries that in the past would have been career-ending. Taking these and other contributing factors into consideration though, experts generally regard the most important factor to be changes in the way athletes train, specifically the increase in training loads. In many cases the evolution of training practices has been dramatic. In 1954, Roger Bannister was the first human to run a sub-four-minute mile. He achieved this feat while a full-time medical student and was limited to no more than 30 minutes of training a day (2004), a duration that many contemporary athletes would spend merely warming up. Mark Spitz swam his way to Olympic gold medals in world-record times at the Munich Olympics in 1972 by training a maximum distance of 10,000 yards a day, a volume that many age-group swimmers matched or even exceeded within two decades. This trend toward greater

training has also become evident in team sports, racket sports, and non-endurance events where there is a growing premium to achieve peak athletic conditioning.

Along with the rise in training loads, it has become common to train and compete year-round in many sports, even for young athletes. This raises the question as to how long these practices can continue before records stop falling or athletes begin to break down. In fact, it has been long recognized that training regimens that improve performance for the majority of athletes will paradoxically have dire consequences for other individuals of equal skill and conditioning, a phenomenon described in the medical literature over a hundred years ago. This condition was initially referred to as staleness or the staleness syndrome, but currently it is more generally called the overtraining syndrome (OTS). Other, less frequently used labels include the unexplained underperformance syndrome (UPS), inadequate recovery syndrome (IRS), and non-functional overreaching (NFOR). The defining symptom of OTS is a serious loss in the capacity to train and compete at customary levels that persists for several weeks or longer. Importantly, this performance decrement is deemed to be precipitated by training stress paired with insufficient recovery rather than from a preexisting condition such as an illness or injury. Other factors, particularly psychosocial stressors, are regarded to be secondary contributors to the condition, but research quantifying their influence is lacking. The initial stage of OTS, or cases in which performance has stagnated or is just beginning to deteriorate, is referred to as overreaching, and can usually be treated with short periods of reduced training or with a short layoff of a few days. There is some debate as to the role of overreaching as some researchers regard it as an undesirable condition that should always be avoided, whereas others consider it is a useful or even necessary phase in a training regimen that, if carefully managed, will result in a greater training adaptation and improvements in athletic performance. Aside from the chronic loss of performance, OTS is associated with a large number of signs and symptoms that occur with varying frequency. Among the most common are medical illnesses such as upper-respiratory infections and mood disturbances, particularly depression. Various behavioral symptoms have been noted, including sleep disturbances (longer sleep onset, frequent awakening, poor sleep quality) and a loss of appetite. Perceptual changes are also common, including increased perception of effort for training and competition, muscle soreness, and feelings of heaviness in the arms and legs.

There is evidence that some athletes who experience OTS may be at an increased risk of developing burnout, which in turn may precipitate a withdrawal from the sport entirely. Burnout has been defined as a persistent condition associated with work settings that is "primarily characterized by exhaustion, which is accompanied by distress, a sense of reduced effectiveness, decreased motivation, and the development of dysfunctional attitude and behaviors at work" (Schaufeli & Enzmann, 1998, p. 36). It is important to emphasize that the original literature on burnout addresses very different samples and precipitating conditions than overtraining, yet sports psychologists have often regarded these conditions as synonymous. Moreover, only limited empirical research has been published on burnout with athletes, and the extant literature indicates that they are distinct conditions that require different treatment interventions. The primary distinction noted in the literature is that many athletes with OTS still report being motivated to continue training and competing whereas athletes suffering from burnout exhibit a loss of motivation and are contemplating quitting or retiring from their sport.

TREATMENT

In the earliest descriptions of overtraining, the need for rest was recognized; athletes have been advised to stop training in their sport for a period of weeks if not longer. Rest does not mean complete inactivity, and athletes should be encouraged to participate in recreational activities or other moderately vigorous pursuits that they enjoy. Medical testing is recommended, not only to rule out other conditions and illnesses that share similar symptoms with OTS, but also to initiate treatment for colds and other infectious disorders common in athletes with OTS. Because it has been found that upwards of 80 percent of athletes with OTS exhibit depression of clinical severity, psychological treatment has also been recommended. This may involve counseling or other forms of cognitive therapy, but in more severe cases, medication may be necessary. There is no evidence that standard sports-psychology performance interventions (e.g., imagery, goal setting) are beneficial.

PREVALENCE

While OTS has been regarded to be a problem endemic to athletes who train intensively for most any sport, there has been little published information as to its prevalence. Survey research involving collegiate

swimmers and other endurance athletes undergoing competitive training have reported the yearly rate of OTS to average approximately 10 percent (range: 7–21%) but the higher percentages reported in some studies may be inflated because of merging cases of both overtrained and overreached athletes. In the first investigation on the lifetime prevalence of OTS, it was found that fully 60 percent of elite female and 64 percent of elite male distance runners reported experiencing one or more episode of OTS during their running careers, whereas the rate dropped to 33 percent for nonelite adult runners. Notably, the weekly training mileage of these runners was significantly lower than the elite athletes, supporting the view that the exposure to training directly increases the risk of OTS, regardless of athlete status (i.e., elite or nonelite). These results also indicate that male and female athletes who undergo comparable training loads are at similar risk of OTS, whereas earlier reports suggested that females were less likely to be affected.

More recent reports indicate the rate of OTS in young athletes to be comparable with findings for adults. In a study involving 231 age-group swimmers from four countries, Raglin et al. (2000) had participants complete a questionnaire in which they were queried about their training practices and whether they had ever become overtrained. It was found that 34.6 percent of the entire sample reported at least one case of overtraining (R: 20.5% to 45.1%), which persisted for an average of 3.6 weeks. These athletes had faster personal best times in the 100-meter freestyle and were involved in the sport for a longer period of time than swimmers who had never had a case of OTS (6.0 versus 4.9 years), consistent with the findings involving adult runners.

Athletes who have developed OTS appear to be at a greater risk of developing it again. Among freshmen varsity swimmers who developed OTS during their first collegiate training season of training, 91 percent became overtrained again one or more times during the following three years of training, whereas the rate was only 34 percent in swimmers who did not develop OTS their freshman year. A higher-than-expected rate of OTS has also been found in elite Swedish junior skiers who became overtrained during their first competitive high school season. Whether these findings indicate some individuals are inherently prone to developing OTS when exposed to overload training, or whether succumbing to OTS raises the risk of relapse, is yet unclear, but both possibilities reinforce the importance of preventing athletes from ever developing the disorder.

PREVENTION STRATEGIES

It is clearly preferable to prevent athletes from becoming overtrained than having to treat them. Although most experts would agree that OTS can be avoided by not training intensively, this is not a sensible option for either the aspiring athlete or coach. Consequently, attention has turned to identifying symptoms or markers that can be used to reliably diagnose athletes in the early stages of OTS where short-term reductions in training or rest periods are likely to be effective. Most of this research has focused on traditional exercise physiology measures involving cardiovascular, metabolic, and hormonal variables. The timing or setting of these tests has utilized resting conditions as well as both during and following recovery from standardized exercise or sport tests of strength or endurance.

The first major review of this literature was published over two decades ago (Kuipers & Keizer, 1988), and the authors concluded that useful markers of OTS had yet not yet been identified. A follow-up review by Fry and associates (1991) identified over 80 potential markers of OTS that had been examined in the published literature, yet concluded that: "At present there is no one single diagnostic test that can define overtraining" (p. 32). Despite considerable research in the years since these initial reviews, the goal of identifying a reliable marker of OTS remains elusive. In perhaps the most comprehensive recent review of the literature published to date, Urhausen and Kindermann (2002) concluded that "there has been little improvement in recent years in the tools available for the diagnosis of OTS" (p. 95).

Despite these disappointing findings, literature reviews have identified a number of physiological variables that do reliably change in accordance with training volume or intensity but fail to distinguish between healthy (i.e., adaptive responses to training) and overtrained athletes (i.e., maladaptive responses to training). A smaller subset of physiological markers have been found to exhibit at least some degree of specificity for identifying OTS, and these include reduced muscle glycogen, elevated cortisol, and decreased leptin. However, for a marker to be of practical value, it must respond during the initial phase when an athlete is overreached rather than overtrained. If it changes only after the athlete has a fully developed case of OTS, then it is of little value beyond corroborating a diagnosis. Because performance decrements indicative of overreaching or OTS can begin to occur following intensive training programs as brief as a few days in duration, a useful diagnostic measure should be able to be taken daily and provide results with little or no delay. These

requirements rule out physiological markers that involve technically demanding procedures or time-consuming analytical procedures (e.g., cortisol). Another serious limitation is that many physiological markers require invasive procedures (e.g., blood drawing or muscle biopsy).

Because of the previously described concerns along with the fact that most physiological measures are not useful in identifying OTS, researchers have turned to examining other categories of markers of staleness, particularly self-report measures including assessments of mood and motivation, perception (ratings of perceived exertion, soreness, fatigue, heaviness), and behaviors (sleep, appetite). Among these variables there is evidence that validated psychological measures, particularly mood states, are more consistently associated with training load and OTS compared to the majority of biological measures. In addition, self-reports are also advantageous because they can be completed and scored quickly in the field at little cost. However, it is crucial that psychological measures be administered and interpreted by individuals with appropriate training. In order to reduce the occurrence of response distortion, whereby psychological questionnaires are completed in a uniformly positive manner regardless of how individuals actually feel, it is important to ensure the confidentiality of study participants. Another option is to have study participants also complete so-called "lie scales," which can detect cases of response distortion, but this procedure has only rarely been used in overtraining research.

MOOD STATE MONITORING DURING SPORT TRAINING

The potential efficacy of psychological monitoring was first recognized by William Morgan and colleagues at the University of Wisconsin, who initiated a long-term study of the mood state response of college swimmers during their training season. Their research utilized the Profile of Mood States, or POMS (McNair, Lorr, & Droppleman, 1992), a 65-item Likert format questionnaire that measures the psychological factors of tension, depression, anger, vigor, fatigue, and confusion. Morgan combined these mood variables to create a more general, global measure of mood disturbance by summing the negative POMS factors (Tension, Depression, Anger, Fatigue, Confusion), subtracting the positive POMS factor of Vigor and adding a constant of 100. This measure has since been adopted by the developers of the POMS and has been widely used in studies of both athletes and nonathletes. Based on the standard instructions, individuals respond to each POMS item according to how they have been feeling "last week including today." This results

in moderately stable mood measures (r_{tt} = .45 – .74) that are unaffected by a single treatment or stressors of brief duration, but which can be altered by persisting stimuli such as chronic sport training.

Initial research revealed that periods of intensive training resulted in significant increases in the negative POMS factors and a decrease in vigor in swimmers who at the outset of the season exhibited positive scores on all the POMS factors, widely referred to as the iceberg profile and commonly found in successful athletes across many sports. This finding led to follow-up studies in which the POMS was administered more frequently during training on a monthly or even weekly basis. The results of this work indicated that each increase in training load was closely tied to a corresponding elevation in mood disturbance, with the most severe mood disturbances occurring during peak training. Decreases in or tapering of training loads resulted in improvements in mood state, and by the end of the training season, mood state scores had returned to their preseason values for most of the athletes. This dose-response relationship between training load and mood state did not differ in the men and women swimmers except in cases in which the teams underwent significantly different training regimens. Figure 4.1 presents a typical example for a college swimming team. Subsequent research by Morgan and other researchers

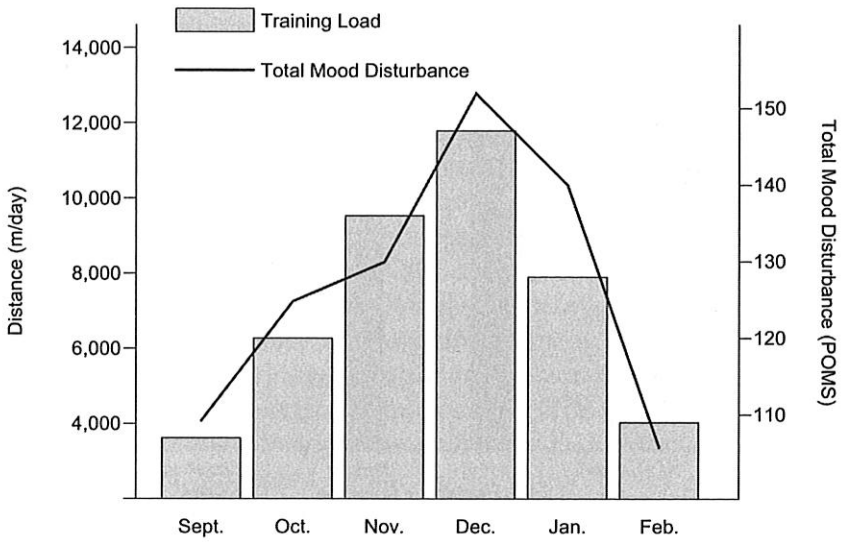

Figure 4.1. Changes in POMS total mood disturbance scores during a training season in a sample of college varsity swimmers.

has replicated these findings in other athletes in a variety of endurance sports as well as non-endurance sports that incorporate rigorous training regimens.

Similar dose-response relationships have been observed using other self-report Likert-scales of mood and other variables including perception of effort, muscle soreness, and feelings of heaviness, although the degree to which these factors change in response to heavy training differs. In a study of age-group young swimmers from four countries (Raglin et al., 2000), a consistent trend was found for self-reports of feelings of heaviness to increase the most during hard training, followed by perceived exertion of training, whereas sleep and appetite were the least altered (Figure 4.2).

The majority of POMS overtraining studies have involved assessments throughout an entire competitive season (i.e., 4 to 6 months) but for some sports it is common to have training camps or programs in which large increases in training are rapidly implemented during a period that may be as brief as a few days. In this case the instructions of the POMS are altered, with athletes responding according to how they are feeling "today" or "right now," yielding a *state* measure of

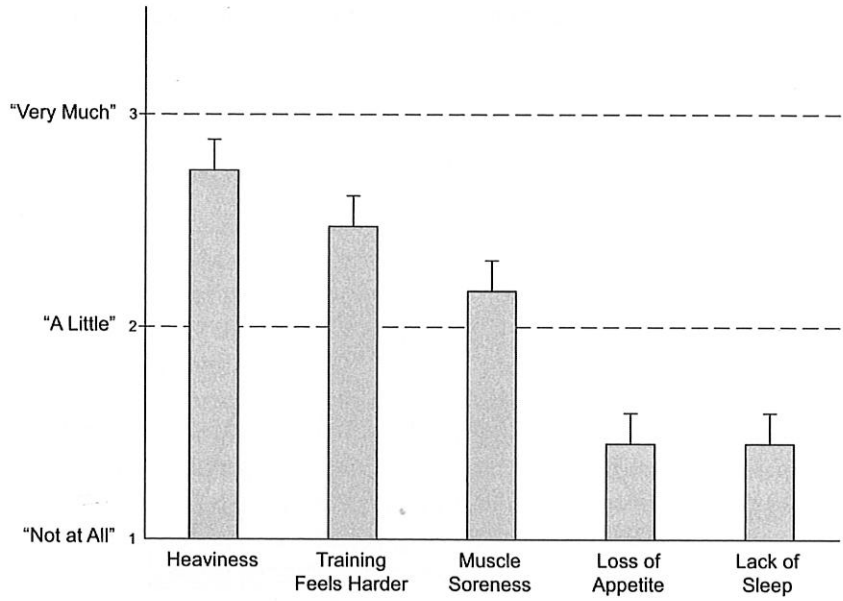

Figure 4.2. Mean ratings of training-related perceptions of young swimmers during peak training. (Adapted from Raglin et al. [2000], *Pediatric sport science*)

mood responsive to acute stressors and that can change in intensity across a brief period of time (e.g., hours or minutes). The results of this research reveal that little as 2 to 4 days of intensified training (> of 50% baseline training) can result in significant increases mood disturbances (Raglin & Wilson, 2000). In research that included physiological measures, cortisol and heart rate remained unchanged, indicating that psychological assessments are more responsive to the acute stressors imposed by rapid elevations in training.

MOOD DISTURBANCES IN HEALTHY AND OVERTRAINED ATHLETES

Although the finding that mood state is consistently altered by changes in training load is notable, the more important practical concern is whether mood differs between athletes who successfully adapt to hard training and those who develop OTS. This research paradigm has involved either contrasting mood state values during a training season between team members identified by their coaches as overreached or overtrained with those who underwent the same training regiment but who remained free of the disorder, or subjecting research participants to standardized training protocols and comparing the responses of those who adapt with athletes who are experiencing signs of overreaching. In the latter case it should be emphasized that when individuals showed signs of overreaching, the training was terminated as it would be unethical to intentionally produce OTS. The results of this work indicate that during periods of intensive training, total mood disturbance scores are consistently higher in athletes showing signs of overreaching or OTS, although exceptions have been noted.

There is also evidence that pattern of mood-specific disturbances is unique in overtrained athletes, an observation that provides further support for the potential of the POMS as a practical tool. Studies of collegiate swimmers indicate the POMS factors of fatigue and vigor exhibit the largest shifts from easy to peak training among athletes who remain free from OTS, with depression exhibiting the smallest elevation among the remaining POMS factors. Athletes with OTS exhibited a different pattern; in addition to larger shifts in all the POMS factors, it was found that depression exhibited the largest elevation of any single POMS factor. Other research involving overtrained swimmers has found that POMS depression scores were significantly correlated with salivary cortisol, implicating the involvement of a central dysregulation in the Hypothalamic-Pituitary-Adrenal axis.

ENHANCING THE POMS TO ASSESS OVERTRAINING RESPONSES

Although the previously described research indicates the POMS has potential in identifying individuals at risk of developing OTS, several factors may constrain its efficacy in identifying overtrained athletes. Aside from the potential occurrence of response distortion, the POMS subscales vary in their sensitivity to the stress of athletic training. Some factors, particularly confusion, have been found to be relatively insensitive even to intense overload training. Other work indicates that some POMS factors are sensitive to stressors unrelated to OTS. Unlike other POMS factors, scores on the tension variable often remain elevated or even increase during training tapers in college swimmers, and it has been speculated that this reflects the impending stress of major competition.

More fundamentally, the POMS was designed for general use and not specifically for athlete samples or sport settings. In the field of sports psychology, there is a long-standing practice to employ sport-specific psychological measures under the belief that existing measures are insensitive or too general to assess to the unique environment of sports or characteristics of athletes. Therefore, researchers have developed over 300 sport-specific psychological measures of personality, motivation, and mood to be used in specific sport situations (e.g., competition) or groups (e.g., runners). Unfortunately, many of these scales have not been adequately validated, and so their efficacy remains to be demonstrated.

In an effort to enhance the sensitivity of the POMS to detect OTS, Raglin and Morgan (1994) analyzed mood responses in a sample of 186 college varsity swimmers who had undergone mood testing throughout their training. Statistical procedures were used to identify the POMS items that responded to the greatest degree among those athletes who were showing signs of overtraining (i.e., overreaching) or were diagnosed with OTS. The analyses identified five items from the POMS depression scale and two from the anger scale. This seven-item pool was labeled the Training Distress Scale (TDS) and subjected to additional testing. A subsequent analysis examined whether the TDS would be more accurate in identifying athletes with OTS compared to the standard POMS subscales using a sample of 29 college track-and-field athletes who completed the POMS during their most intense phase of training. The team coach identified six athletes in the sample who were experiencing performance problems directly

attributable to overreaching or OTS. The researchers anticipated that athletes who possessed mood disturbance scores one or more standard deviations above the mean value for the entire team would be either overreached or overtrained, and assignments using the TDS were compared to those made based on the POMS total mood disturbance score as well as the POMS depression scale in order to compare their relative efficacy. It was found that predictions using each of the POMS scales correctly identified overreached and overtrained athletes at rates that exceeded chance ($P < .05$), but the TDS was more specific and resulted in fewer false positives (i.e., predicting OTS when athletes were actually healthy) compared with those based on either total mood disturbance or depression scores. The TDS has since been translated into several languages and found to be efficacious in assessing mood changes during age-group athletes. Specifically, TDS scores were higher in young athletes who reported symptoms of staleness compared with healthy competitors.

Other scales have been developed by researchers who contend that measures specifically devised to assess overtraining and recovery should provide even greater efficacy than general psychological measures such as the POMS. Unlike the TDS, which was established using empirical procedures, these scales were created according to theoretical assumptions about what psychological and behavior factors should be associated with OTS. The most extensively studied instrument has been the RESTQ (Kellman & Kallus, 2001), a 76-item questionnaire encompassing 19 separate factors that assess both overtraining and recovery responses in endurance athletes. Initial work indicates that the RESTQ can identify athletes with signs of staleness, but accuracy rates have not been published, nor has the efficacy of this measure been directly compared to the POMS or other scales.

Some research has been conducted to determine if mood state monitoring can be used as a practical means to reduce the occurrence of OTS in athletes who must undergo intensive overload training. In the most ambitious of these studies, Berglund and Safstrom (1994) used the Swedish language version of the POMS to conduct weekly assessments in elite men and women race canoeists who were training for the Olympics. Using each athlete's own baseline total mood disturbance score as a criterion, when an athlete's own total mood disturbance score exceeded baseline by at least 50 percent, training was reduced until scores fell to within 10 percent of the baseline. In contrast, low mood disturbance scores were regarded by the authors as indicative of undertraining. Consequently, such cases lead to increasing training loads until mood

disturbance scores rose to a point regarded as indicative of beneficial overreaching. Of the entire sample, 64 percent had training reduced at some point and 57 percent had training increased, indicating that some athletes required each intervention during different phases of the training program. None of the athletes developed signs of OTS, a decrease in the average 10 percent rate found in previous training seasons. Although these results are promising, further testing of this and similar approaches is needed involving larger samples and non-intervention control conditions. If these results are replicable and generalize to other sports, then mood state monitoring in combination with selected physiological assessments, may well provide an effective means of reducing the risk of OTS in competitive athletes while also potentiating the performance benefiting effects of intense training.

GENERAL SUMMARY

Intensive physical conditioning is a necessary aspect for most sports, yet it is inherently stressful and results in both physiological and psychological disturbances. Fortunately, most athletes are able not only to tolerate this stress, but to adapt to it with improved performances. For reasons that remain poorly understood, some athletes fail to adapt and develop the overtraining syndrome, suffering from chronic performance decrements that persist for weeks or months. While physiological research on OTS has enhanced our understanding of the disorder, the findings of this work have had little practical impact for coaches and athletes; OTS remains an intractable problem that has resisted the concerted efforts of scientists, coaches, and trainers to prevent it. However, a growing body of research indicates that mood state and other psychological variables are closely associated with training volume, both with schedules that are altered gradually across a period of weeks or months and those that are more rapidly altered. Furthermore, both the magnitude of disturbance and specific pattern of mood disturbance is unique in athletes with OTS, and some research has exploited these findings to successfully prevent the occurrence of OTS by altering training loads in response to mood changes. Several recently developed questionnaires have been created specifically to assess the psychological consequences of OTS, but even if research proves these scales to provide enhanced sensitivity and specificity over extant measures, their efficacy will be further enhanced by integrating mood assessments into a more comprehensive monitoring strategy integrating relevant physiological, performance, and nutritional information.

The approach of using mood state monitoring to examine the issue of overtraining is a telling example of how carefully conducted sports psychology research can contribute to our understanding of difficult problems in sports and exercise. The complexity of the overtraining syndrome compellingly demonstrates that most phenomena in sports are best understood as psychobiological rather than either physiological or psychological. Moreover, it is an example in which the experience of stress, if managed appropriately, is ultimately beneficial. This perspective has recently become accepted, if not embraced by exercise scientists but was recognized long ago by the father of American sports psychology, Coleman Roberts Griffith, who stated: "The athlete, at work and at play constitutes a fine laboratory for the study of vexing physiological and psychological problems, many of which are distorted by the attempt to reduce them to simpler terms" (Griffith, 1929, p. vii). Researchers and coaches would be wise to follow his advice.

RECOMMENDED READING

Morgan, W. P., Brown, D. R., Raglin, J. S., O'Connor, P. J., & Ellickson, K. A. (1987). Psychological monitoring of overtraining and staleness. *British Journal of Sports Medicine, 21*, 107–114.

Raglin, J. S. (1993). Overtraining and staleness: Psychometric monitoring of endurance athletes. In: R. N. Singer, M. Murphey, & L. K. Tennant (Eds.), *Handbook of Research on Sport Psychology.* (pp. 840–850). New York: Macmillan.

Urhausen, A. & Kindermann, W. (2002). Diagnosis of overtraining: What tools do we have? *Sports Medicine, 32*, 95–102.

REFERENCES

Bannister, R. (2004). *The Four-minute mile.* Guilford, CT: The Lyons Press.

Berglund, B., & Säfström, H. (1994). Psychological monitoring and modulation of training load of world-class canoeists. *Medicine and Science in Sports and Exercise, 26*, 1036–1040.

Fry, R. W., Morton, A. R., & Keast, D. (1991). Overtraining in athletes: An update. *Sports Medicine, 12*, 32–65.

Griffith, C. R. (1929). *The psychology of coaching*. New York: Charles Scribner's Sons.

Kellmann, M. & Kallus, K. W. (2001). Recovery stress questionnaire for athletes: User manual. Champaign, IL: Human Kinetics.

Kuipers, H., & Keizer, H. A. (1988). Overtraining in elite athletes: Review and directions for the future. *Sports Medicine, 6*, 248–252.

McNair, D. M., Lorr, M., & Droppleman, L. F. (1992). *Manual for the profile of mood states.* San Diego, CA: Educational and Industrial Testing Service.

Raglin, J. S., & Wilson, G. (2000). Overtraining and staleness in athletes. In: Y. L. Hanin (Ed.), *Emotions in sports* (pp. 191–207). Champaign, IL: Human Kinetics.

Raglin, J. S., Sawamura, S., Alexiou, S., Hassmén, P., & Kenttä, G. (2000). Training practices and staleness in 13–18 year old swimmers: A cross-cultural study. *Pediatric Sports Medicine, 12,* 61–70.

Schaufeli, W., & Enzmann, D. (1998). *The burnout companion to study and practice: A critical analysis.* Philadelphia: Taylor & Francis.

Urhausen, A. & Kindermann, W. (2002). Diagnosis of overtraining: What tools do we have? *Sports Medicine, 32,* 95–102.

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit formation. *Journal of Comparative Neurology of Psychology,* 18, 459–482.