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A NEW INTEGRATIVE MODEL OF OVERTRAINING BASED ON BURNOUT AND STRESS-RECOVERY PSYCHOLOGICAL APPROACHES

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Abstract: The basic concepts and psychological issues related to overtraining syndrome are reviewed in the first part of the present article. The most important models that, from different approaches, try to explain this situation are then presented. In the second section, models related to the burnout hypothesis, such as Smith's cognitive-affective model (1986), Schmidt and Stein's sport commitment model (1991), Coakley's social model (1992), Kelley's stress and burnout model (1994) and Garcés and Vives's integrated model (2003) are exposed. The hypothesis of the stress-recovery state is subsequently developed, explaining the most significant implications of both stress and recovery in sport. The characteristics of two of the most important models based on this hypothesis: Kellmann's scissor model of stress-recovery state (1991) and Kenttä and Hassmén's stress-recovery state model (1998) are described. Finally, in order to get a better understanding of the short and long-term manifestations of overtraining, a new model based on both the burnout and stress-recovery approaches is proposed.

Key words: Overtraining, models, burnout, stress, recovery.

Resumen: En la primera parte del presente artículo se revisan los conceptos básicos y los aspectos psicológicos relacionados con el síndrome de sobreentrenamiento. A continuación se presentan los diversos modelos que han intentado explicar el sobreentrenamiento desde diversas perspectivas. En primer lugar los modelos relacionados con la hipótesis del burnout, tales como el modelo cognitivo-afectivo de Schmidt y Stein (1991), el modelo social de Coakley (1992), el modelo del estrés y burnout de Kelley (1994) y el modelo integrado de Garcés y Vives (2003). Posteriormente, se desarrolla la hipótesis del estrés-recuperación, explicando sus implicaciones más significativas en el ámbito deportivo. Se describen las características de los dos modelos basados en dicha hipótesis: el modelo de la tijera de Kellmann (1991) y el modelo del estado de estrés-recuperación de Kenttä y Hassmén (1998). Finalmente, a fin de llegar a una mejor comprensión de las manifestaciones del sobreentrenamiento a corto y a largo plazo, se propone un nuevo modelo basado en la aproximación del burnout y del estrés-recuperación.

Palabras clave: sobreentrenamiento, modelos, burnout, estrés, recuperación.

Title: *Un nuevo modelo integrador del sobreentrenamiento basado en las aproximaciones psicológicas del burnout y del estrés-recuperación*

Overtraining is a condition where athletes' level of performance is reduced even when they are not apparently suffering from a lesion or an illness. In the literature (Kuipers, 1998; Suay, Ricarte & Salvador, 1998; Steinacker & Lehmann, 2002), a distinction is made between short-term overtraining and long-term overtraining, identifying both as transitory conditions. In the first case it is less severe and has the possibility of recovery in a short period of time, whilst in the second case the condition lasts longer, it is more severe and recovery does not occur quickly.

In sport psychology, other terms such as staleness (Bonete & Suay, 2003; Gould & Dieffenbach, 2002) and exhaustion

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(Weinberg & Gould, 2003) are usually used to refer to short and long-term overtraining respectively. Staleness is associated with a series of behavioural symptoms and disorders such as physical fatigue, mental fatigue, bad temper, apathy or sleep disorders, amongst others (Suay, 2003). The athlete then enters into a vicious circle, manifested by a sensation of uneasiness, by feeling negative about performing, or by a predisposition to mediocrity which in addition generates anxiety (Henschen, 1993). Exhaustion is associated with long-term overtraining and carries more severe negative implications for the athlete, who, faced with excessive stress, enters into a physical and emotional vacuum (Dale & Weinberg, 1990; Suay & Salvador 2003). Depression is probably considered to be the most typical psychological aspect of long-term overtraining (O'Connor, 1998). However, the negative influence it has on motivation is also important, given that fatigue signifies a psychological, emotional, and sometimes, physical withdrawal.

In the following sections of this theoretical study, the various psychological models which have dealt with the problem of overtraining will be first examined. Two different approaches have been used; one is related to burnout, and the other looks at the relationship between stress and recovery. Because no model in the literature really integrates common aspects of burnout and stress-recovery, a new model, based on the analysis of both theories, is proposed in order to reach a higher level of understanding of the short and long-term manifestations of overtraining.

Stress, burnout and overtraining

According to Tucker (1990), stress is an important agent in the pathogenesis of multiple physiological, psychological and behavioural disorders of varying severity. Thus, many experts have been claiming for decades that one of the best approaches to combat the negative effects of stress is to maintain a suitable level of physical activity (Crews, Lochbaum & Lander, 2004; Kull, 2003; Sandlund & Norlander, 2000). In principle, the existence of a positive relationship between the practice of physical activity and a reduction in stress levels and increase in well-being from a health point of view, seems self-evident (Alonso-Arbiol, Falcó, López, Ordás & Ramírez, 2005).

However, in other contexts, such relationship is not so clear. Kleine (1994), for example, claimed that the results of studies showing a reduction in stress through the use of physical exercise were inconsistent with respect to long-term effects. Berger and Owen (1992) did not accept that the positive relationship between physical exercise and stress could be extended to any type of activity. In addition, Goodway (1987) suggested that exercise is in itself a source of stress which triggers off a series of changes in the organism. Based on the above, a distinction is made in the literature between positive stress or eustress, if it stimulates and motivates the individual to achieve an aim, and facilitates adaptation to the surrounding environment (Daley & Welch, 2003; Wyshak, 2001), and negative stress or distress if it produces demotivation towards task completion and lack of self-control, and generates an inadequate response to the surrounding environment (Márquez, Montorio, Izal & Losada, 2006).

Some authors consider that well-being and optimal functioning of the organism in any context requires a certain level of stress (eustress), but when this exceeds certain limits it provokes the opposite effect, inhibiting the effective functioning of emotional, mental and physiological capacities (Landero & González, 2006; Márquez,

2004). For Crocker (1989), stress is caused by the so-called "stress-inducing" stimuli experienced by the subject, which can produce different reactions according to each individual person and the specific circumstances and can affect performance negatively. In the same way, according to Madden, Summers and Brown (1990), a situation of stress can arise before, during or after the situation related to performance, such as, for example, a sporting competition.

Anshel (1990) puts forward a series of severe stress-inducing agents in relation to sports, such as: pain following a lesion; making technical or tactical mistakes; not having the required level of physical fitness; reactions to the success of a rival; unfair referee decisions; unfavourable competition results; being jeered at by the public; rebukes from the trainer; intimidation by the opponent; criticism from team members; etc (Miguel-Tobal, Navlet-Salvatierra & Martín-Díaz, 2001). Other more long-term, stress-inducing factors could be the great demands made on the athlete by competition, monotony of training, critical style of the trainer (always focusing on mistakes), feelings of being at a standstill, dissonance between the athlete's original expectations of the sport and reality, lack of support from his/her social circle, lack of intrinsic motivation for the activity, repression of tensions and conflicts generated, taking on excessive responsibility for the objectives and/or functions of the team, or multiple commitments outside of the world of sport (Hollander & Mayers, 1995; Márquez, 2006).

Many specialists consider Freudenberger (1974) as one of the first researchers to introduce the concept of burnout in a scientific context. His original idea was later developed by different authors; in 1981 Maslach and Jackson established the concept of burnout in a more extended manner which is widely admitted nowadays. According to Feigley (1984), burnout in sport represents a progressive alteration as a consequence of a continuous and exigent task. During this process, there are psychophysical alterations, small at the beginning but progressively increasing (Garcés, 2004).

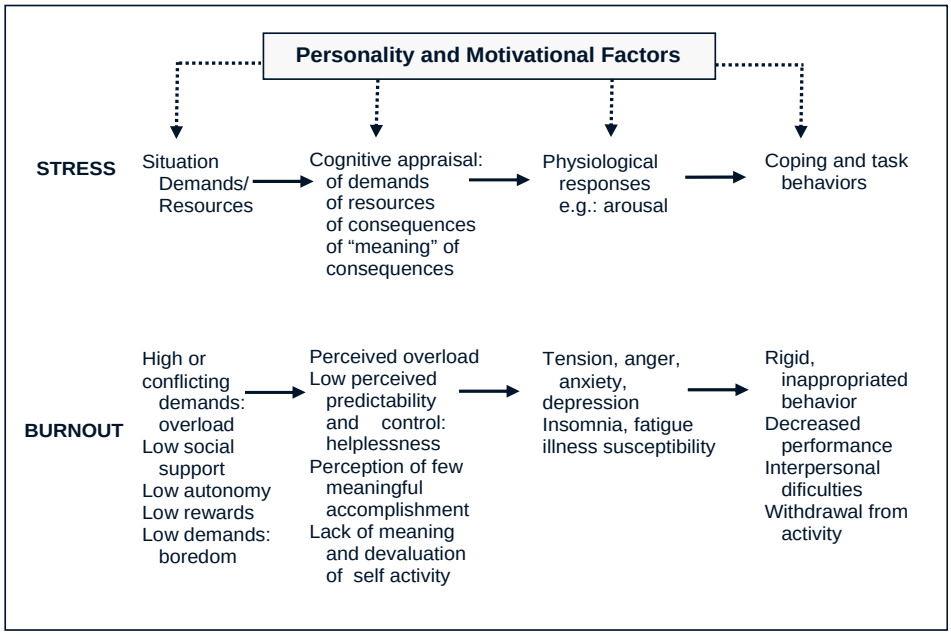
Similarly to other contexts, in the sports setting there is a link among acute, temporal and reversible manifestations of stress and burnout. This is the cronicity of the stress manifestation during the adaptation process in which the subject fails. In other words, and according to different authors (Anshel, 1990; Kelley, 1994; Martin, Kelley & Eklund, 1999), burnout is a consequence of the cronification of a typical response to stress. During the process of burnout, situational demands maintain the perception of damage or threat while necessary resources for coping are perceived as insufficient (Garcés & Cantón, 1995). Athletic training physically and psychologically stresses athletes and can have both positive and negative effects. Most athletes seek a positive adaptation when training. However, too much training may lead to negative training responses, with individuals progressing to overtraining and ultimately to burnout if the stress due to training is not reduced (Gould & Dieffenbach, 2002).

Different models based on burnout theory have tried to explain the phenomena observed in overtraining. Smith's burnout model (1986) or cognitive-affective model, is probably one of the most relevant to the sporting context. This author maintains that burnout is the result of a process whereby the subject is submitted to a series of potentially negative elements which generate stress; these are perceived to be insurmountable, causing uneasiness, as well as physiological and behavioural symptoms which point to a state of exhaustion. Di-

fferent interrelated elements are evident in this model. One is the situational component, which is determined by the relationship between the demands of the situation and personal resources. Later, a cognitive appraisal of the situational components and the implications which could be potentially threatening for the subject is made. Once this happens, a series of physiological and behavioural responses are sparked off, which can affect the person's performance and well-being, eventually causing exhaustion. In regards to the repercussions and final implications of exhaustion, the model considers motivational factors as well as personal characteristics of each subject as mediating factors (Figure 1). Recent developments of the model put emphasis on the Cognitive-Affective Processing System (CAPS) described by Mischel and Soda (1995), a dynamic network of cognitive, affective, motivational and behaviour-generation units that interact with situational factors to produce both coherence and cross-situational variability in behaviour (Smith, 2006). The CAPS framework has been considered an interesting approach for measurement and case conceptualization as well as treatment methods (Shoda & Smith, 2004).

In 1992 Coakley proposed a model of burnout known as social model. According to the author, burnout arises from social elements inherent in the organisation of professional sport which affect the identity and autonomy of the athlete. This approach considers that the structure of competitive sport does not allow the development of a normal, multi-dimensional sense of personal identity among athletes. They are "obliged" to construct an identity focused on the achievement of competitive success, preventing them from developing other aspects of their personality, and even from establishing a different kind of relationship with people or activities outside (and even within) their sport, which would give them some space from the situation of subjection

Figure 1. Cognitive-Affective Model (Smith, 1986)



in which they find themselves. This single-purpose identity of athletes that the author describes is also fostered by a lack of personal control over their lives, given that their parents or trainers are the ones who dictate what they must and must not do at any one time. The athletes become "performance machines", an attractive situation when they are the centre of attention, valued and highly regarded. However, when they see that the demands made are increasingly higher and that those around them have made an enormous investment in their sporting career, they realise that failure means letting others down. This generates a situation of stress which could have negative repercussions on performance, leading to a social and emotional withdrawal, clinically manifesting itself in the form of symptoms of burnout. Coakley's model is important due to the emphasis it places on the social environment, aiding in the development of specific recommendations for preventing burnout. In one of the more comprehensive studies published to date, Gould and his colleages (Gould, Tuffey, Udry & Loehr, 1996a, 1996b, 1997) developed a three-part investigation of bournout in junior tennis athletes. When results were examined under the light of Smith's (1986) and Coakley's (1992) models, both appeared to receive the same support.

Very close in time is Schmidt and Stein's sport commitment model (1991). Sport commitment occurs when an individual demonstrates persistence participating despite intervening factors such as school work, jobs, and family responsibilities. Based on this concept, Scanlan and coworkers have described a conceptual framework designed to account for persistence behaviour in sports settings (Carpenter & Scanlan, 1998). In the case of sports, commitment is defined as a psychological state representing the desire or resolve to continue sport participation (Scanlan, Carpenter, Schmidt, Simons & Keeler, 1993). Sport commitment model is based on a balance between positive and negative factors acting on the athlete over time, which will determine commitment to the sport practiced. The kind of commitment that subjects develop towards the world in which they compete will determine their level of continuity in the activity. Fatigue or exhaustion provoked by the sport will appear according to five stable positive and negative components related to the activity. These components are: rewards, costs, satisfaction, alternatives and investment (Table 1). If the rewards obtained are high, costs involved are low, level of satisfaction is high, alternatives other than sport are low, and investment is increasingly high, then commitment based on activity enjoy-

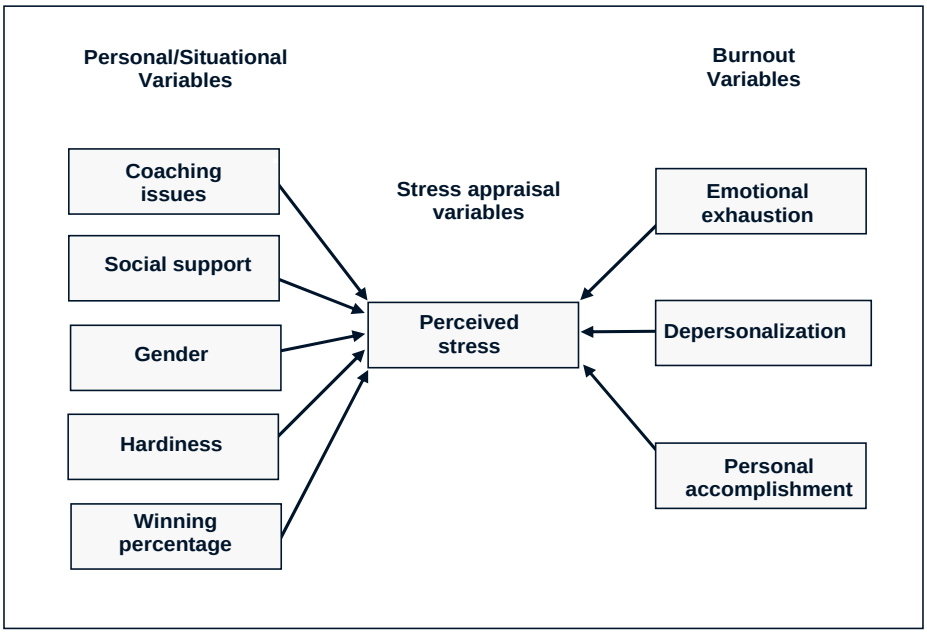
Table 1. Sport Commitment Model (Schmidt & Stein, 1991)

	Commitment (enjoyment-based)	**Commitment (burnout)**	**Dropout**
Rewards	Increasing (or high)	Decreasing	Decreasing
Costs	Low	Increasing	Increasing
Satisfaction	High	Decreasing	Decreasing
Alternatives	Low	Low	Increasing
Investments	High	High (or increasing)	Decreasing

ment is assured. On the other hand, if the athlete perceives that the costs involved are high, rewards are low, possible alternatives in daily life are limited or non-existent, and investment is high, then he/she will become a person who is very vulnerable to burnout. In this situation, subjects continue with their commitment to their sport but nevertheless are incapable of obtaining benefit from it. Such people are obliged to continue with an activity which does not bring them sufficient rewards and does not satisfy them, and in which they must give too much of themselves; thus, continuing the activity leads to burnout. Finally, this model considers a third possibility, in which rewards have diminished, costs have increased, satisfaction is reduced as is investment, but other better alternatives to the sport are available. This results in dropout, where the subject would be able to withdraw from sport because of the possibility of more attractive and satisfying alternatives. Sport commitment model has been tested by Raedeke (1997) on a group of 236 swimmers, the results obtained being consistent with many of the model's predictions.

Kelley's model of stress and burnout (1994) suggests that exhaustion is the result of a prolonged and continual increase in stress caused by interaction with other people during the development of skills in the sporting world. The model considers the inter-dependence between personal and situational factors, individual appreciation of stress levels based on these factors and externalisation through burnout according to the three spheres defined by Maslach and Jackson (1981) (Figure 2). In the initial conceptualization of the model, stress factors were not directly linked to burnout, rather they influenced individual perception of stress. Personal variables influencing the perception of stress contemplated in the model include gender and energy, whilst social variables considered are satisfaction with social support, number of victories, and problems with the team management. The model claims that scant so-

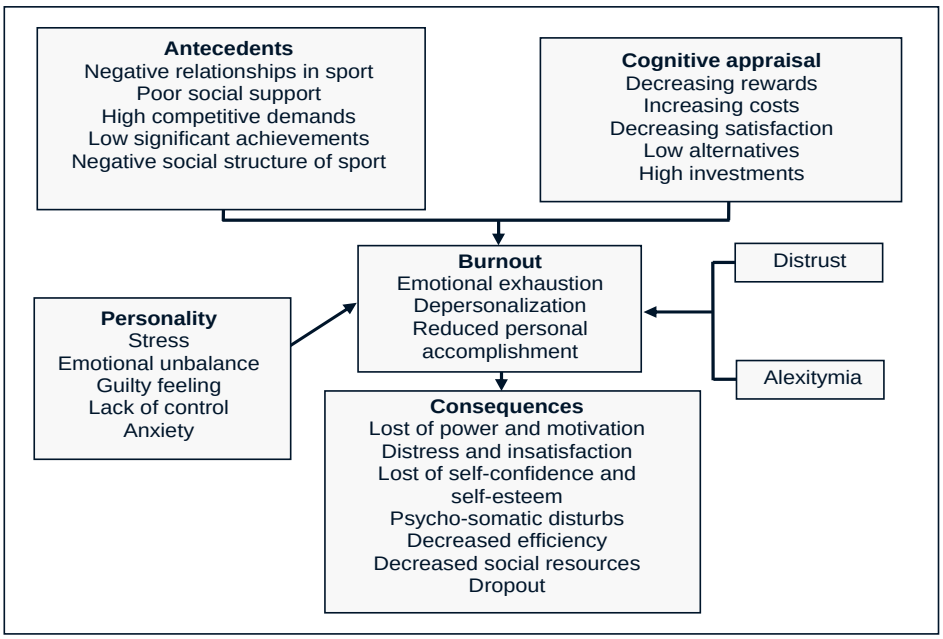
Figure 2. Stress and Burnout Model (Kelly, 1994)



cial support, problems with the team management, being a woman or a person with a low level of activity or energy, and a low number of victories are factors which lead to a greater perception of stress. This, in turn, induces an increase in exhaustion and depersonalisation, and low levels of self-realisation in the athlete, which are the three spheres through which burnout is manifested. Later adaptations of the model confirmed that the personal and situational factors which directly influenced perception of stress also influenced the level of burnout in athletes (Martin et al., 1999). Differences in gender and sport type detected among collegiate athletes support some of the model's predictions (Cremades & Wiggins, 2008).

Garcés and Vives's burnout model (2003) is known as the integrated model. This model, partly based in achievement motivation theories, attempts to bring together, in a somewhat eclectic form, the characteristic features of the previous models emphasising the dimension associated with personality factors. The fact that a model can have different outcomes depending on the individual subject is determined by these factors. Starting from the cognitive-affective approach to burnout developed by Smith (1986), Coakley's social dimension (1992) is then incorporated, as is Schmidt and Stein's (1991) idea of commitment and Maslach and Jackson's tri-dimensional concept of burnout (1981). The model proposes that expression of burnout is influenced by the presence of five interrelated elements. These are: the antecedents or situations favouring burnout; the cognitive appraisal carried out by the subject; personality variables; dimensions in which burnout is expressed; and somatic, psychological or social consequences (Figure 3). Very recently Garcés and Cantón (2008) have developed a further theoretical proposal which considers three groups of predictive variables (personal, family/social, and sport), three temporal dimensions (emotional exhaustion, depersonalization, and reduced personal

Figure 3. Integrated Model (Garcés & Vives, 2003)



accomplishment), and a mediating role for personality variables.

Stress-recovery state and overtraining

As can be appreciated from the previous paragraphs, the explanations of the overtraining phenomenon based on the theory of burnout, focus almost exclusively on the dimension of stress: its presence or absence, surrounding circumstances, individual predispositions, manifestations, and overcoming strategies. These models may be useful for construct elaboration, assessment of individual differences, and interventions in sport psychology. However, they are based on a theoretical framework that needs to be expanded. It has been recently suggested that the existence of high levels of stress over a long period of time does not necessarily result in a situation of overtraining, as long as adequate strategies for recovery are employed at the same time (Kellmann, 2002; Kenttä & Hassmén, 2002). In the same way, the majority of definitions encountered in the literature consider overtraining to be the result of an imbalance between agents favouring stress and agents favouring recovery. It is for this reason that another part of the literature considers not only the dimension of stress in relation to overtraining, but also another directly related dimension, that of recovery (Jürimäe, Mäestu, Purge & Jürimäe, 2004; Kellmann & Kallus, 2001; Kenttä & Hassmén, 2002; Mäestu, Jürimäe, Kreegipou & Jürimäe, 2006).

The concept of recovery is directly related to that of fatigue, identified as a protective, temporary and reversible response that sets off an alarm and prepares the organism for later adverse consequences manifested by an alteration in homeostasis (Weineck, 2004). Fatigue affects all levels of the organism's functions, whether molecular, sub-molecular, cellular, organic or systemic, and can even affect an individual's relationship with the surrounding environment (Sergeyevich & Dimitriyevich, 1995). From a psychological perspective, it has been claimed that just as sport training provokes physical fatigue, so it also gene-rates psychological fatigue which, accor-ding to the demands sustained by the athlete during training or competition, can lead to psychological exhaustion (Buceta 1998; Salvador, Ricarte, Moya Albiol & González-Bono, 1997). Other authors such as Henschen (1993) consider psychological fatigue to be an early warning signal, before entering into a state of burnout, principally where a loss of motivation, a lack of interest and a reduced level of capacity is perceived by the individual (Astrand, Rodahl, Dahl & Stromme, 2003). Exhaustion leads to the development of a negative self-concept, negative attitudes towards work, life, and other people, as well as a loss of idealism, energy and aspirations (Freudenberger & Richelson, 1981). Some authors (Vanuxem, Fornaris, Kone, Vanuxem & Commandre, 1990) use the term "establishment" of fatigue, when initial stages of exhaustion become chronic as a result of an imbalanced relation between stress and recovery over a period of time.

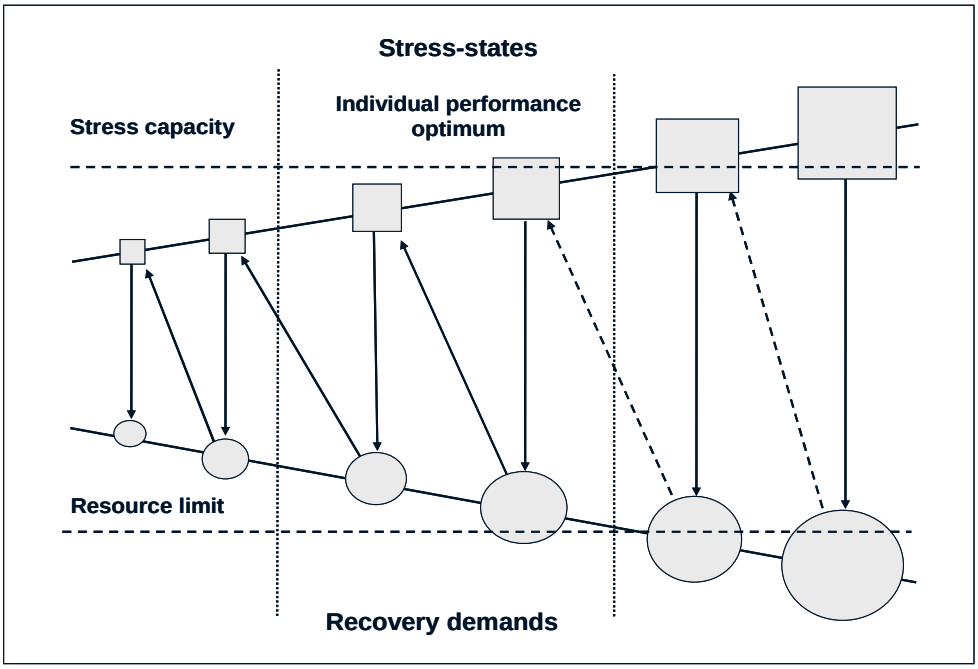
As with burnout, recovery can be understood as a complementary element to fatigue caused by short-term or long-term distress, as it happens in burnout. Following this idea, Bompa (1999) claims that the recovery or regeneration of an athlete is a multifunctional construction process, which will depend on factors which are both intrinsic and extrinsic to the subject, through which the organism will recover and augment lost potential. Kenttä and Hassmán (1998) consider the recovery process to be the re-establishment of homeostatic balance, which will allow a satisfactory adaptation. Time necessary for a satisfactory recovery will depend on the degree of affectation. In a parallel way, an

attenuation of the stimulus which is eroding the athlete is necessary. During initial stages, the athlete will need a few hours or days to regain a homeostatic equilibrium; in situations of prolonged burnout this period is insufficient.

For Kellmann and Kallus (1999), recovery includes the process of re-establishing physical and psychological resources. These authors make a distinction between recovery and regeneration, claiming that regeneration is a form of recovery only associated with high performance levels, whilst recovery is applicable to other situations. Nevertheless, both concepts correspond to positive emotions and moods. Some years later, the same authors (Kellmann & Kallus, 2001) defined recovery as a multi-modal, inter- and intra-individual process (psychological, physiological and social), through which performance qualities are re-established. It includes an active component directed by the subject, whose activities can be systematically used to optimise personal conditions and reconstruct personal resources.

Two models have been proposed in order to try to explain the interrelation between stress and recovery when considering the implications of the processes of overtraining. The first is Kellmann's "scissor" model of stress-recovery (1991), which sees situations of stress, need for recovery, individual capacity for withstanding stress and personal resources for recovery as inter-related (Figure 4). This model (Kellmann, 1991, 2002) is based on the idea that as a person's stress level increases, recovery becomes correspondingly more necessary. When subjects experience stressful situations, they have at their disposal a series of resources with which they can face situations. As stress-inducing situations increase, so does the need for recovery, that is to say, individual regenera-

Figure 4. Scissor Model (Kellmann, 1991)

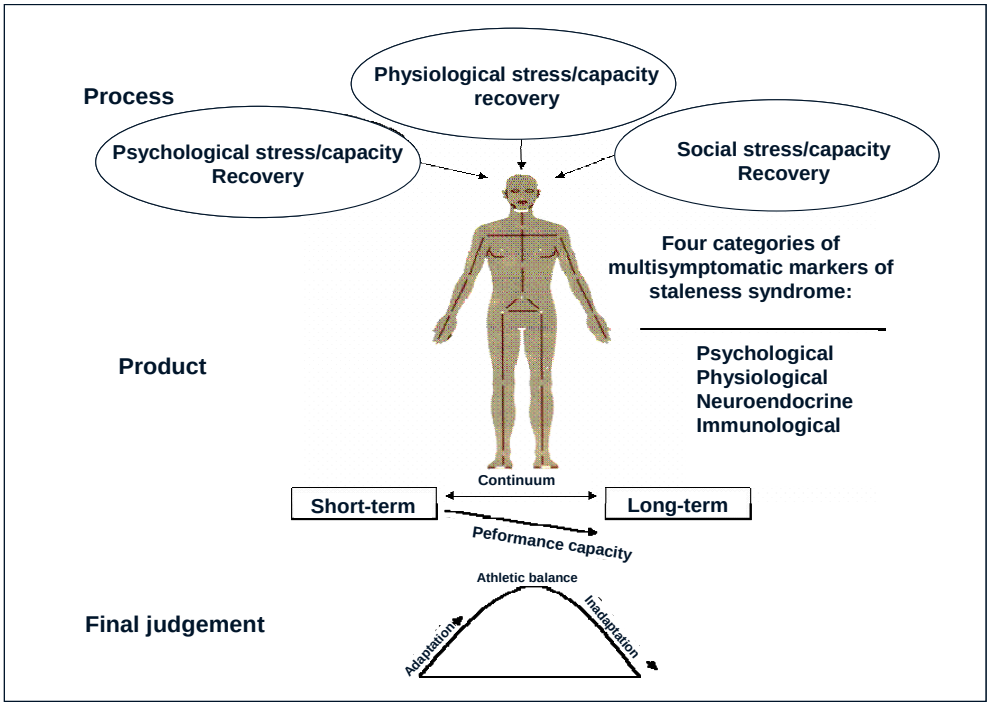


tion is needed. If the capacity to tolerate stress is compensated by adequate recovery resources, the subject is balanced. However, when recovery resources begin to be inferior to the situational demands of stress, a vicious circle begins for the athlete, given that recovery needed in order to compensate for the stress (which is augmenting) is not sufficiently dealt with by individual recovery resources (González-Boto, Salguero, Tuero, Kellmann & Márquez, 2008). When this situation occurs, the logical balance between stress and recovery is shattered, causing the subject to experience a gradual rise in stress levels without experiencing a parallel complete recovery from them, with the attendant possibility of exceeding individual capacity for resistance to stress. If the resources are appropriate, the subject may react satisfactorily and cope perfectly well with stress without needing to use additional recovery activities. Even in this situation, it is possible to tolerate moderate levels of stress up until a certain point. This is a case of "balance between stress and recovery", where the subject enjoys optimal conditions in order to attain satisfactory levels of adaptation and performance. One of the central ideas behind this model is precisely the fact that, given that the athlete knows, has and uses the necessary resources for recovery, stress can be positively tolerated. However, in the absence of recovery, or in the situation of "underrecovery", the athlete initiates a process of stress which can lead to levels which are too high once they have gone beyond the threshold of the optimal margin. In this instance, the increase in stress will limit the possibility for recovery, making additional help necessary in order to recover the lost performance level completely. It could be said that underrecovery is a precursor to overtraining (Kellmann, 2002).

Once the relationship between stress and recovery has been looked at, the model goes on to consider the analysis of overtraining on the basis of the recovery-stress state of the individual over time. Short-term overtraining can be understood, according to the circumstances, as a planned reduction of recovery in favour of an increase in stress provoked by workload, which later triggers off a process of supercompensation (González-Boto, Salguero, Tuero, González-Gallego & Márquez, 2008; Lehmann, Foster, Gastmann, Keizer & Steinacker, 1999; Smith, 2003). If the situation is prolonged over time and adequate recovery does not occur, underrecovery becomes chronic and leads to the condition of the overtraining syndrome (Kuipers, 1988), more recently named as unexplained underperformance syndrome (Budgett et al., 2000; Robson, 2003). Positive change to the stress-recovery level may come about as a result of a reduction in stress or, more commonly, the development of activities related to recovery, which in turn need to be of a nature and magnitude related to the deterioration generated, if the aim is to achieve a complete, satisfactory recovery (Kallus & Kellmannn, 2000; Kellmann & Günther, 2000; Kellmannn & Kallus, 1999).

The second model is the Kenttä and Hassmén's model of stress-recovery (1998), which tries to provide an explanation from a physiological, psychological and social perspective, based on knowledge of the interacting parameters which determine both performance improvement and performance deterioration. The model distinguishes three interrelated levels (Kenttä & Hassmén, 1998, 2002): process of overtraining and recovery, consequences, and final result in relation to performance (Figure 5). The process of overtraining and recovery deals with the cause which determines the appearance of overtraining based on factors which intervene interactively and cumulatively over a period of time. The process in its entirety de-

Figure 5. Stress-Recovery Model (Kenttä & Hassmén, 1998)



pends on three levels: physiological, psychological and social. Each level is expressed in one way or another according to three parameters: quantity of stress, quantity of recovery and individual capacity for overcoming stress. In other words, the origin and magnitude of overtraining is determined by the "quantity" of physiological stress, psychological stress, and social stress. Equally, it is also determined by the "quantity" of physiological recovery, and social recovery. Finally, by the individual's capacity or physiological tolerance, psychological tolerance, and social tolerance. When an imbalance occurs between stress and recovery, a series of negative consequences arise distributed among four multisymptomatic categories, represented by the overtraining syndrome. These categories are: physiological, psychological, neuroendocrinal and immunological. The final result refers to the situation which results from a period of training when there is an optimal balance between stress and recovery. From the start, the level of performance increases until the point where it provokes a rupture in the stress-recovery balance. Once this happens, there is a gradual reduction in adaptation to the sport, sometimes arriving at very negative situations for the athlete's performance.

A new model of overtraining

As we have shown in the previous sections, overtraining is usually identified as an imbalance in the adaptive cycle of the athlete which leads to a situation of poor performance, premature fatigue and the impossibility of super-compensation during the normal progression of training. Diverse factors may predispose an athlete to overtraining, related to the dynamics of workload management during training and competitions, to other situations related with

the sport, environment or personal circumstances and situations. One approach which attempts to explain the reasons behind overtraining from a psychological perspective is related to the hypothesis of burnout, through different models which consider situational, social, subjective and individual circumstances, as well as the consequences and the effects of overtraining, on a psycho-somatic level centred on a common denominator: stress. Other models exist which consider the relationship established between stress and recovery relevant, and the possibility of imbalance between one and the other throughout the athlete's training period.

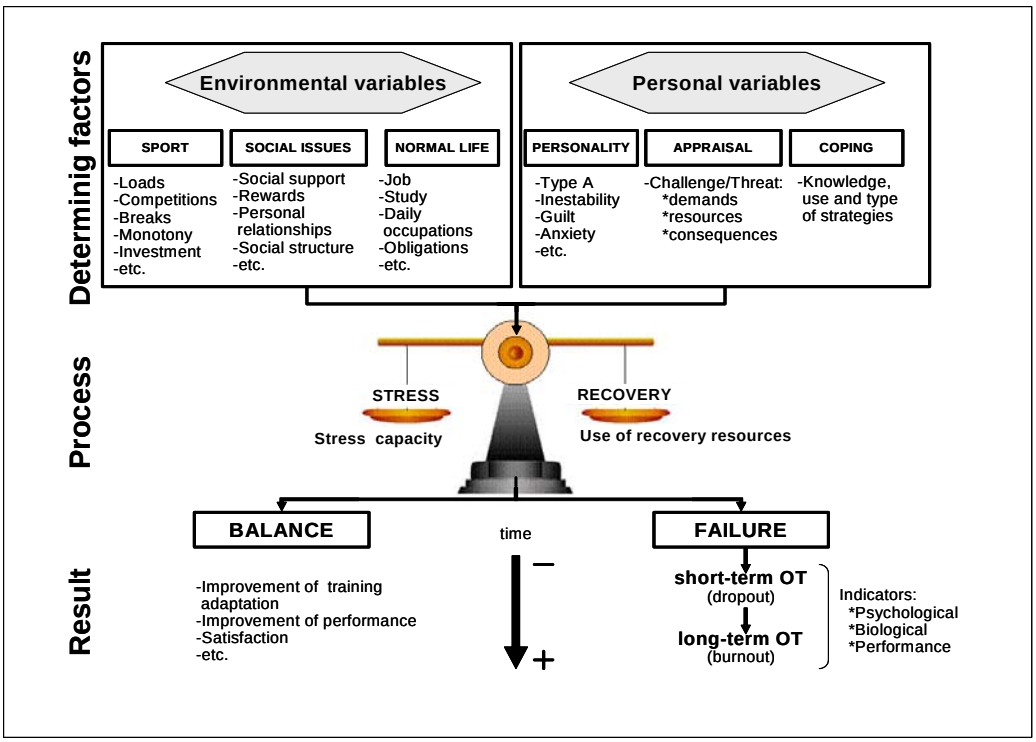
Theoretical models related to both burnout and stress-recovery are closely related, and could be complementary in explaining the overtraining phenomenon.

However, we have found no model in the literature which really integrates common aspects of burnout and stress-recovery. Therefore, a new model is here proposed in which the appearance of overtraining depends on a series of elements that can be clustered into three interdependent fields: determining factors, internal process of overtraining and results or consequences (Figure 6).

Determining factors have been discussed in previous work (González-Boto, Molinero & Márquez, 2006). These factors are included in two main groups: situational variables and personal variables. Personal and situational factors may interact to potentially cause stress or favour a better recovery.

Situational variables refer to environmental elements that may positively or ne-

Figure 6. A new model



gatively influence the athlete. Among them, there is a group of stressors that have been traditionally considered a major cause of overtraining. They come from the practice of sport and are related to high training loads, large number of competitions, unsatisfactory results, lesions and disease. Recent studies confirm that aspects outside the practical component of sport may also negatively influence athletes. Thus, social aspects such as social support, rewards, interpersonal relationships or social structure in the sport, social or familiar context, are related to overtraining. Moreover, daily situations, such as job demands, sleeping hours, work duties, and other activities may contribute to overtraining.

Personal variables are within the individual sphere, and are basically associated to personality characteristics and to cognitive aspects related to information processing. In relation to personality, it has been reported that subjects with a Type A personality show a tendency to overtrain, which is also linked to manifestations of anxiety, lack of control, etc. Cognitive appraisal of the situation is also important. There is a tendency to fail if stimuli are perceived as an insurmountable threat, while a satisfactory adaptation is possible if stimuli are perceived as a challenge.

Determining factors per se do not induce a negative response to stress. They may favour an inadequate response, or favour a state of optimal health and well-being and an adequate recovery, depending on their direction or intensity. In other words, determining factors may positively or negatively influence the "quantity" of stress and recovery.

The relationship among stress and recovery agents will determine the development of overtraining. According to the literature definitions, overtraining is the consequence of an imbalance between stress and recovery. This means that when the balance is secured athletes will be able to progress in sport adaptation, performance will be improved and there will be a greater satisfaction. The maintenance of the balance will depend on the individual capacity to tolerate stress and the capacity to use resources favouring a better reco-very. Athletes will be able to increase stress level within an optimal tolerance range, provided that they have the nece-ssary resources for an adequate recovery. If this is not the case, stress level will overpass the acceptable tolerance level, and recovery resources will be insufficient to adequately cover such demands. The consequence is a balance loss, a failure in the athletic progression and a decrease in health status. Failure is detected through psychological, biological and performance indicators.

Results

Although imbalance between stress and recovery is conceptually identified with overtraining, this does not mean a real overtraining situation per se, because in acute stress contexts there is also a stress-recovery imbalance. Therefore, it is important to consider another key variable: time. Acute stress under these conditions may be considered as a situation preceding overtraining. If the duration of the imbalance between stress and recovery is prolonged in time, athletes will suffer a short-term overtraining. This phase may be similar to the initial stages of burnout. When the situation lasts longer, the long-term overtraining or overtraining syndrome appears. Considering psychological consequences, long-term overtraining may be identified with burnout. Both short-term and long-term overtraining are characterized by a reduced performance, a premature appearance of fatigue, and a series of biological and psychological symptoms and signs that tend to produce a progressive worsening.

Discussion and conclusions

A consideration of theoretical models of overtraining requires not only a mere explanation of the different existing or proposed models, but also the establishment of some practical implications. There are at present research lines of a descriptive character that try to identify sources of overtraining in athletes from the analysis of stressor agents in personal, social and sport contexts, and from the study of the recovery resources employed, such as coping strategies. Other approaches are aimed at understanding how overtraining develops from the analysis of differences between groups as a function of social, demographic and sport variables, such as gender, type of sport, competitive category, etc. Finally, correlation studies attempt to verify the relation between levels of stress-recovery or burnout with other psychological (mood states, anxiety levels, effort perception), biological (hormone level, lactate production) or sport (load intensity and volume, performance) indicators of overtraining. All these proposals can enable psychologists and sport professionals to design intervention programs aimed at detecting and controling negative situations related to overtraining.

Progress in different research lines could benefit from the availability of models which integrate the existing theoretical background. The model of overtraining here proposed tries to make such integration and to couple both the burnout and stress-recovery perspectives with a psychosocial approach. This expanded multidimensional and sequential model could be operationalized through the development of instruments designed to provide practical tools for recognizing overtraining in its different states. It is our hope that the proposed formulation may help in case conceptualization or planning and empirical assessment of treatments. Investigations are however necessary, both in observational and intervention contexts, in order to identify the practical implications of the new model.

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