Physiology of Sport and Exercise

Overtraining Syndrome and Training Monitoring

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Learning Objectives

Concept of overtraining syndrome

How to prevent overtraining monitoring athletes' training dose- response

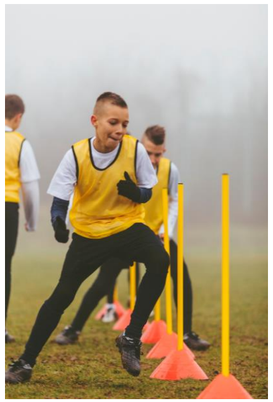
Practical approach - training monitoring

To achieve highest highest performance

Sport at the professional level, looking for ?

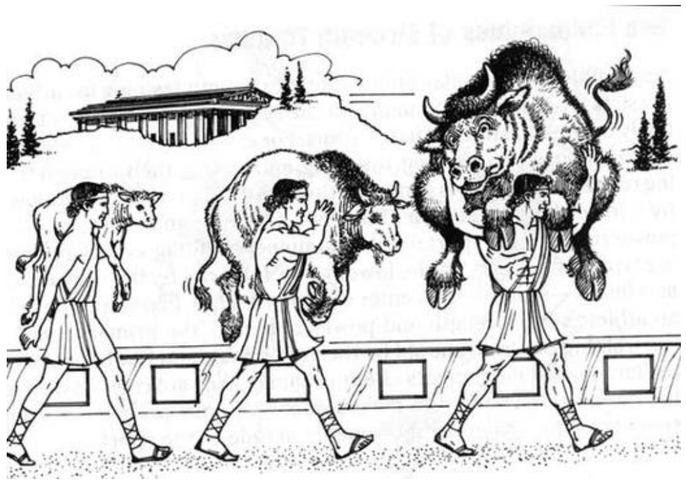
The focus is preparing the athlete/team to reach the peak of performance during competition

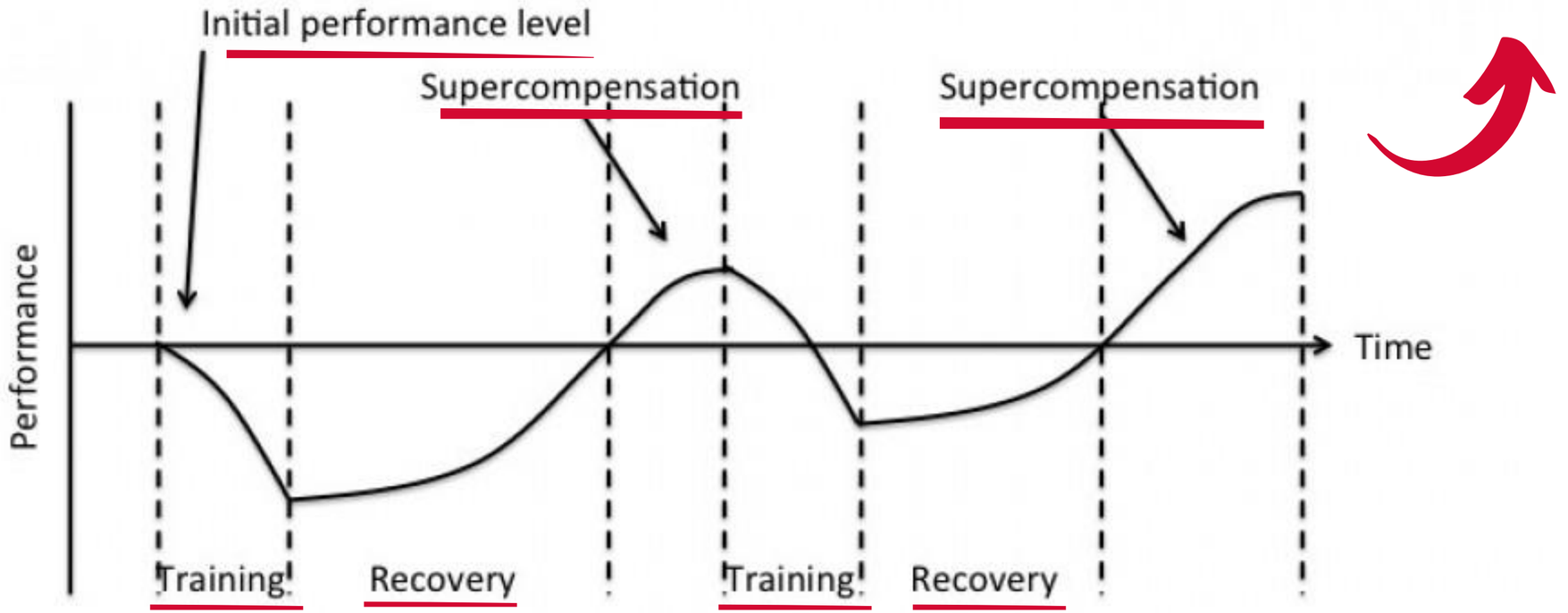
Intense training routine to optimize the athletes' performance - Physical and Technical



Supercompensation: training dose- response

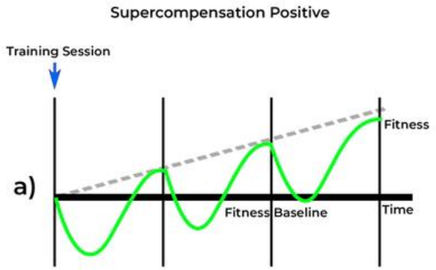
The peak of performance at the competition

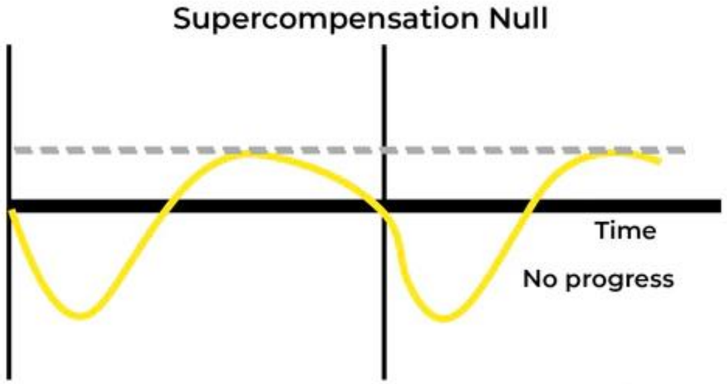


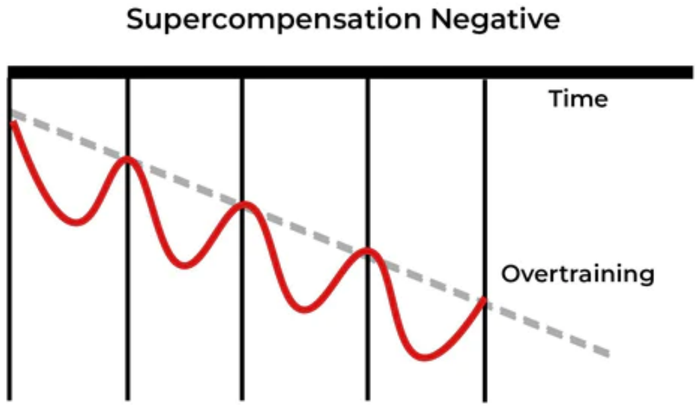


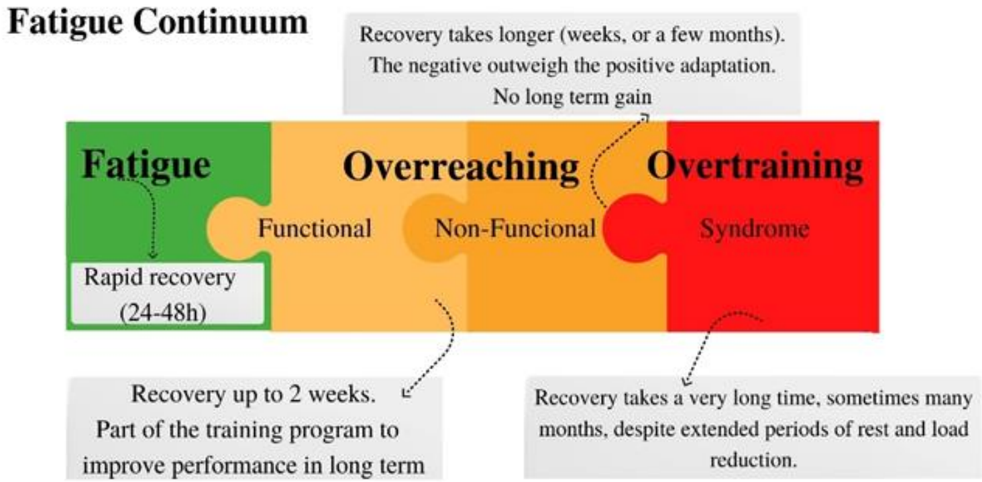
Classic periodization model: A training load followed by recovery results in increased performance (supercompensation).

Supercompensation: positive/null/negative









Overtraining Syndrome (OTS) - Literature Description

Is a condition associated with a long-term imbalance between training and recovery

Characterized by performance decrements, fatigue, and mood disturbances and has been proposed to affect between 20% and 60% of athletes throughout their careers.

OTS is defined as “a sports-specific decrease in performance together with disturbances in mood state. Underperformance persists despite a period of recovery lasting weeks or months.

Issues:

Vague terminology, complex nature.

Difficult to understand, diagnose and treat.

Attention:

Athletic performance

Physiological changes

Psychological signs and symptoms

Weakley, Halson and Mujika (2022)

Decreased sensitivity of serotonin receptors

Increased occurrence of upper respiratory tract infections

Blunted (mitigate) cortisol awakening responses

Blunted (mitigate) hormonal responses to exercise

Increase exercise induced muscle damage

Reduction in maximal performance and time to fatigue. No change in submaximal performance

Mood disturbance and loss of vigour

Decreased caloric intake

Changes in HRV and resting and exercising heart rate

Change in steroid hormone quantity and ratios

Elevated IL-1B, IL-6 and TNF following exercise

Increased risk of injury

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Human Kinetics
BRIEF REVIEW

Overtraining Syndrome Symptoms and Diagnosis in Athletes: Where Is the Research? A Systematic Review

Jonathon Weakley,[1,2,3] Shona L. Halson,[1,2] and Iñigo Mujika[4,5]

[1]School of Behavioural and Health Sciences, Australian Catholic University, Brisbane, QLD, Australia; [2]Sports Performance, Recovery, Injury and New Technologies (SPRINT) Research Centre, Australian Catholic University, Brisbane, QLD, Australia; [3]Carnegie Applied Rugby Research (CARR) Centre, Carnegie School of Sport, Leeds, United Kingdom; [4]Department of Physiology, Faculty of Medicine and Nursing, University of the Basque Country, Leioa, Basque Country; [5]Exercise Science Laboratory, School of Kinesiology, Faculty of Medicine, Universidad Finis Terrae, Santiago, Chile

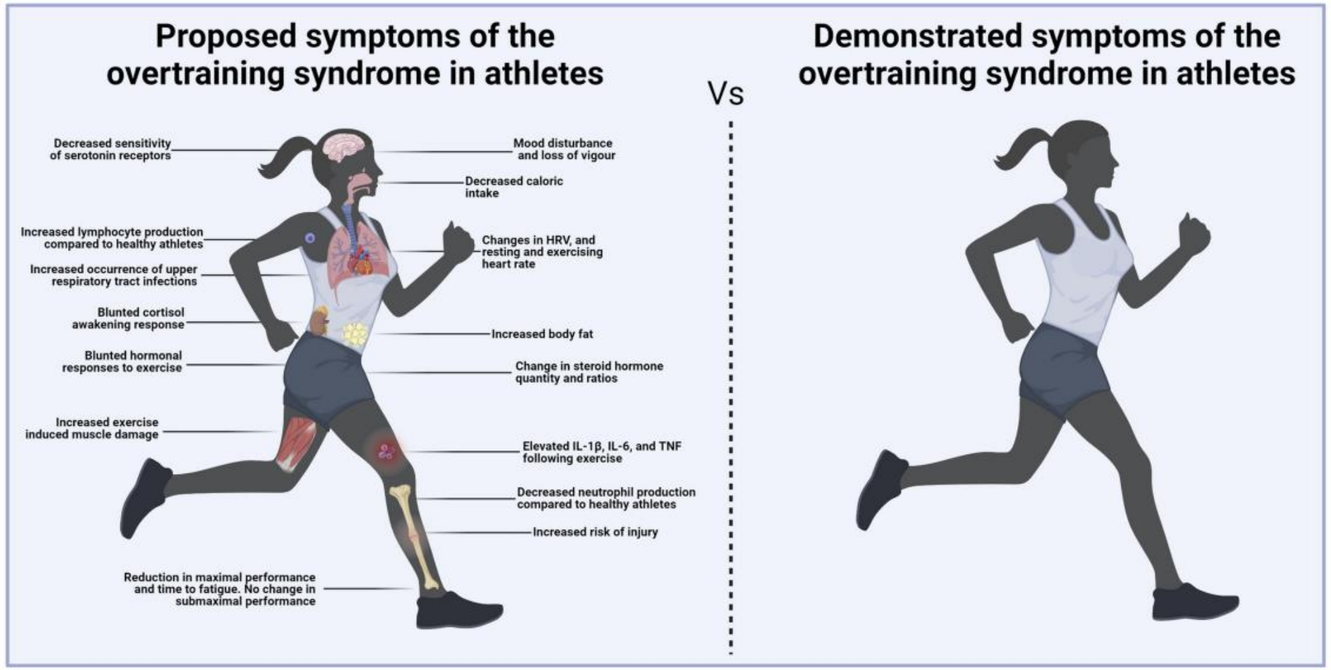


Figure 2 — Proposed and demonstrated symptoms of overtraining syndrome. Information retrieved from references 8–11, 13, 14, 23–25, and 31. HRV indicates heart-rate variability; IL, interleukin; TNF, tumor necrosis factor.

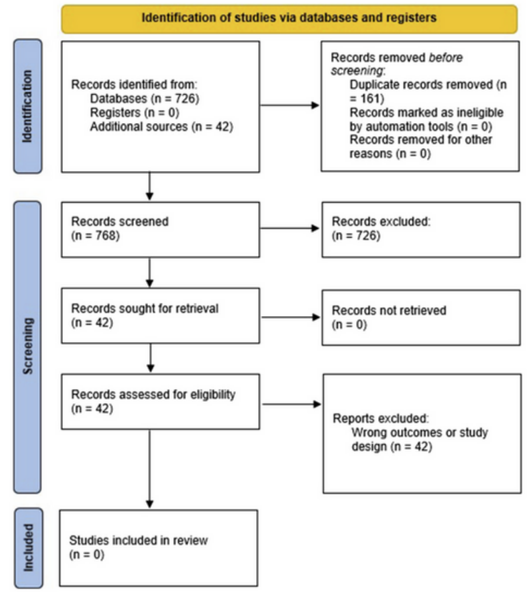


Figure 1 — Flow diagram of search strategy for eligible studies.

It should be noted that while this review cannot provide evidence of sufficient quality regarding changes in performance and mood state associated with OTS, it is plausible practitioners and researchers have indeed observed OTS but have been unable to document these changes

How to prevent and/or diagnose the OTS symptoms?

Monitoring/tracking / registering the athletes' responses to training and competition demands

Which variables and parameters???

Athletic performance

Physical tests

(e.g., sport modality

characteristics)

Sport-specific test

Physiological changes

Cardiac autonomic responses

(e.g., VO2max, HR, HRV)

Hormonal concentration

(e.g., testosterone, cortisol,

estrogen...)

Blood markers

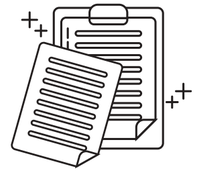
Psychological signs and symptoms

Mood disturbance

Droop on motivation to train and compete

Perception of wellbeing

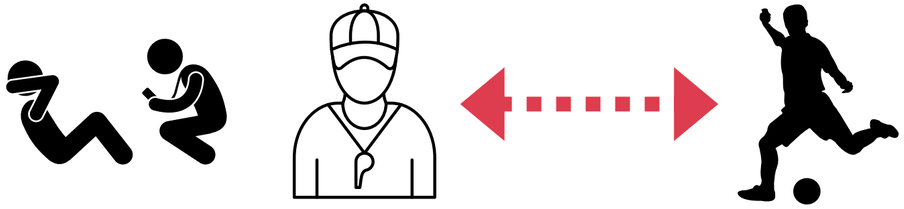
Mental fatigue



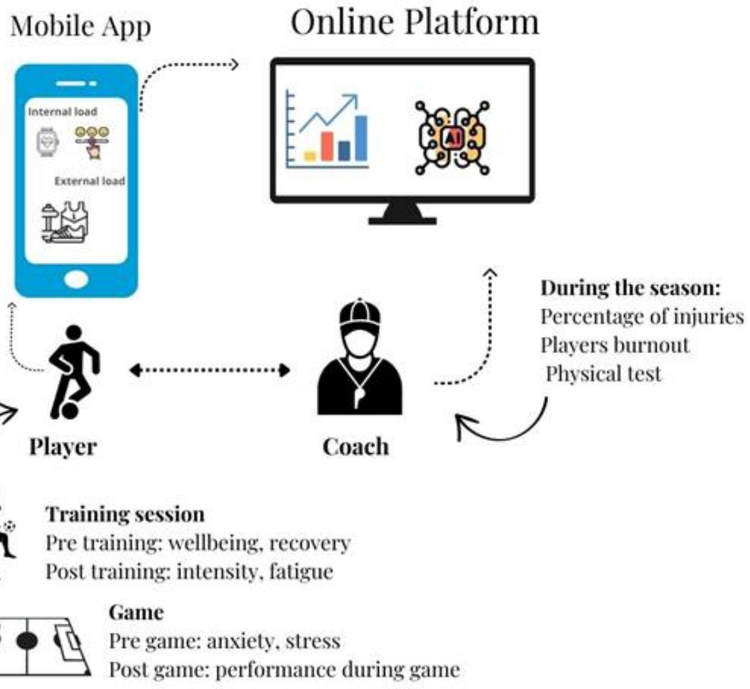
(e.g., evaluation by scales, questionnaires

and athletes' conversation/report)

Monitoring Process



Coach and team-staff **Athlete**



Commercial Platform

Input and data report
Player long-term monitoring
Algorithm to prevent injury and OTS

KITMAN LABS

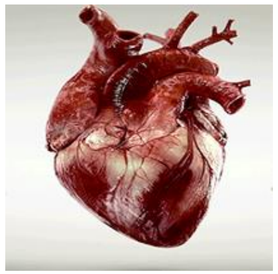
LOAD CONTROL

ACTIMET

HRV4 training application - hands on

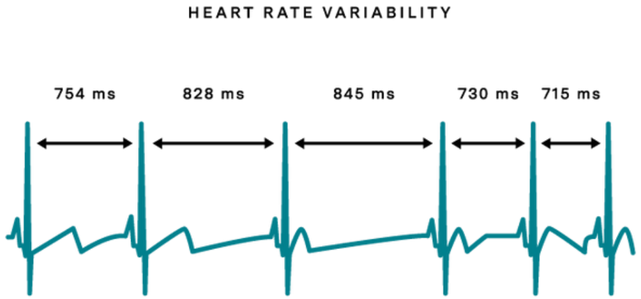
HRV4Training

Sinoatrial Node (pacemaker)



Parasympathetic fibers: inhibitory

Sympathetic fibers: excitatory



Shorter interval: higher bpm
Major interval: slower bpm

Measurement of HRV and perceptual parameters (wellbeing, training intensity and recovery)

HRV values (RMSSD) ↑ **Performance/health**

HRV values (RMSSD) ↓ **Risk of OTS/ stress/ maladaptation**

Preventing chronic fatigue in Czech young athletes: The features description of the “SmartTraining” mobile application

Martina Bernaciková[1]*, Michal Kumstát[2], Iva Burešová[1], Kateřina Kapounková[2], Ivan Struhár[2], Martin Sebera[1] and Ana Carolina Paludo[3]*

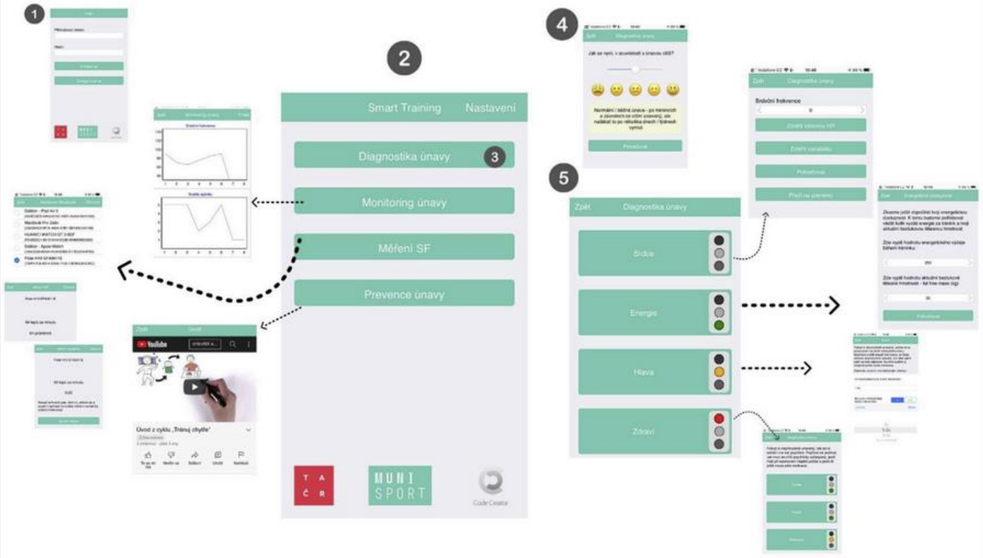


FIGURE 1
SmartTraining main window and stages of fatigue diagnosis. 1) access to the app; 2) main display; 3) fatigue diagnosis; 4) example of perceptual question and the options of answer; 5) fatigue parameters (heart, energy, head, and health) and the semaphore outcome.

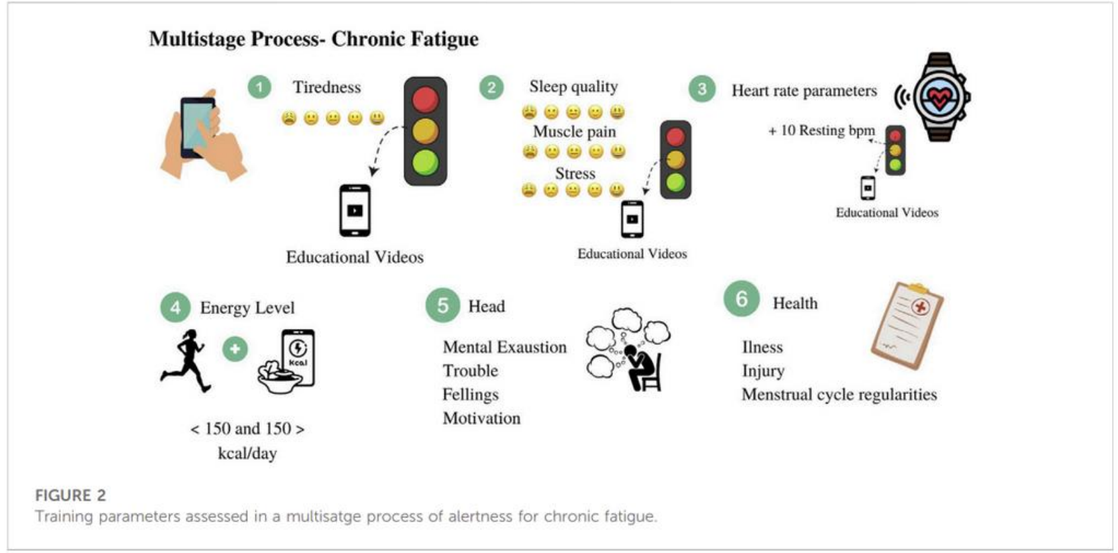


FIGURE 2
Training parameters assessed in a multisatge process of alertness for chronic fatigue.

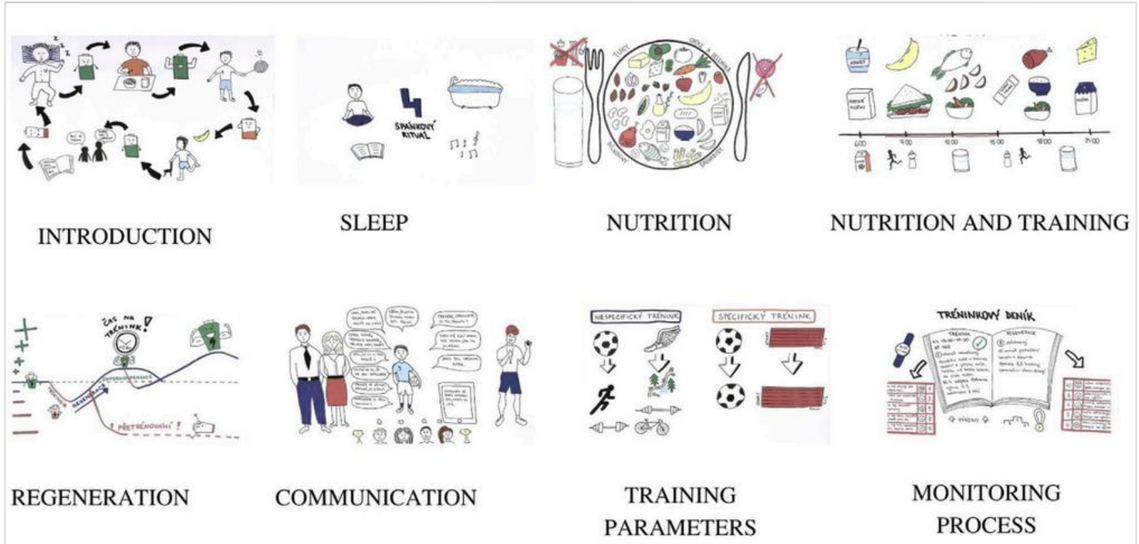


FIGURE 3
The educational part of the app: amination videos related to training demands and recovery (https://www.youtube.com/playlist?list=PL9yCtXX66neQPdsoMZl9gtCV7kz7jZuh0).

Example of a spreadsheet created on excel and Power BI

TAKE NOTE

- Sports at the professional level require high training intensity
- Adequate training load (dose) and recovery is ideal for a supercompensation on performance (response)
- Inadequate training and recovery can trigger the OTS
- OTS is characterized by a decrease in performance and physiological and psychological responses. It will take months to recover (initial conditions)
- OTS is a vague concept
- Monitoring long-term athletes' responses can help to prevent and diagnose OTS
- Many options to monitor/track athletes' physiological and perceptual responses to training. Use of commercial app; coaches can build their own tools.

Obrigada

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Complementary:

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https://doi.org/10.1123/ijspp.2021-0448.

Preventing chronic fatigue in Czech young athletes: the features description of the 'SmartTraining' mobile application
https://doi.org/10.3389/fphys.2022.919982.