

Monitoring internal training load and overtraining in soccer players: a literature review

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Abstract:

The study aims to identify objective, comprehensive and inexpensive scientific methods that help us avoid training errors, and help future professionals to improve sports achievement. We concluded that the methods of monitoring the training load were not combined with the methods and methods of monitoring the trainees - invisible training -, and finally we want to provide an easy, highly objective and reliable method with the lowest cost, least technical expertise and least effort to monitor the internal training load and the players' readiness for subsequent training loads by monitoring wellness indicators.

KEY WORDS : Monitoring internal training load ; overtraining .

المخلص:

تهدف الدراسة إلى التعرف على الأساليب العلمية الموضوعية والشاملة وغير المكلفة التي تساعدنا في قياس الأحمال التدريبية لتفادي الوقوع في أخطاء التدريب، وخلصنا إلى أن ضبط تكميم الأحمال التدريبية لا يغفل عن التدريب الخفي، وأخيراً نريد توفير طريقة سهلة وموضوعية وذات موثوقية عالية بأقل تكلفة وأقل خبرة تقنية وأقل جهد لمراقبة حمل التدريب الداخلي واستعداد اللاعبين للأحمال التدريب الموالية من خلال رصد مؤشرات العافية دون الوقوع في التدريب المفرط

الكلمات المفتاحية: الحمل التدريبي الداخلي؛ التدريب المفرط .

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1-Introduction:

Football is undoubtedly the most popular sport in the world. A study (Arliani et al., 2011) confirmed that there are about 200,000 professional athletes and 240 million amateur players worldwide, 80% of these players are male, and studies have shown that Football players are at 1,000 times higher risk of injury than industrial workers.

Football has undergone many changes in recent years, mainly due to the increased physical demands. This increased the risk of infection. Athletes are more susceptible to injury due to their intense training and the large number of matches they play. An estimated 10-15 football injuries occur in 1,000 hours of training. (Arliani et al., 2011).

The negative consequences caused by all injuries have become one of the main questions waiting to be resolved by the doctor or the technical staff of professional sports clubs (Gómez-Piqueras et al., 2017). The relationship between training and performance is important. Especially for coaches to determine the optimal amount of training required to achieve specific performance levels with the primary objective of providing a training incentive that increases performance potential and reduces the negative consequences of training (ie injury, illness, fatigue, and overtraining)(Gabbett, 2010)

Apart from a few high-level football teams, routine use of the heart rate based method is not always possible due to issues such as technical expertise required, this method is time consuming to collect heart rate data for all the team players in each training session, and the cost of many Heart rate remote measurement system. An additional problem with using heart rate methods to estimate internal training load in team sports such as soccer is that heart rate transmitters are not permitted during official competitive matches. It is considered a hindrance because the internal training load caused by the match may represent a relatively high percentage of the weekly training load. (Impellizzeri et al., 2004)

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And as many researchers, such as (Dellal, 2008) and (Chebbi, 2016), have also acknowledged the lack of methods and methods of evaluation, monitoring and individual and group follow-up of various sports activities that have scientific credibility, and they also emphasized the limited use of many of them, for example, the use of methods that depend On physiological measurements such as the cardiofréquencemètre, the lactato mètre, and the lactate meter, and the internal training of the athlete knows its limitations in the results because it does not take into account the psychological stress that the athlete is subjected to and gives an indication of the internal load, and the (GPS) device It measures the external training load without the internal load, such as the distances covered, the number of accelerations, etc., without taking into account the internal load and the psychological load, and these aforementioned devices give accurate information most of the time, but they are expensive and require a high level of reporting and technical expertise and even analysis The data requires a long time and several specialists, and also does not take into account the personal psychological load (stress) of the athlete. This is what prevents relying on it alone in many sports clubs. Fortunately, in recent years, prestigious sports clubs have known, in particular, to adopt a double method that combines the measurement of internal and external load, as well as psychological stress, a method modified and developed by the American Dr. Carl Foster (Sessoïn RPE) or (RPE) in (1998) and then (2001) and it depends on Rating of Perceived Exertion, which is an easy-to-use, inexpensive and effective method that requires only a follow-up notebook for each player in which he writes down his daily estimates as well as some personal information. The Foster method also has high scientific credibility in various sports, which is proven by previous studies, such as the study of (Foster, 1998) among ice race runners, and the study of (Impellizzeri et al., 2004), (Chihha et, autres, 2015) in football. Wallace, 2009 in swimming, and a study (Coutts 2007) in rugby, and a study (Borges Oliveira, 2013) in the sport of

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boat racing, in training various physical attributes (Foster C, 2001), where they adopted in their studies the descriptive approach between (analytical and comparative) and those who concluded in their results This method (RPE method), which is easy to apply and found effective, allows coaches in various disciplines, such as football, to quantify the training load and follow the players to ensure the best response between the programmed load and the players' abilities to absorb the so-called load actually imposed on the athlete

(Zain El-Din Toumi, 2020) (Zain El-Din Toumi, 2020)

There is also a growing interest in identifying psychological factors associated with athletic performance, as evidenced by the increasing number of sports psychologists and undergraduate sports psychology programs. This may be due to the realization that psychological factors, especially stress, have an impact on physical health, so stress can be activated as a state of stress. Mental or emotional consequences of adverse or demanding circumstances were evident in football.

The authors also reported that injuries were 2 to 5 times more common in athletes with high levels of stress than in athletes with low levels of stress. High life stress versus low life stress. In addition, the risk of infection was proportional to the stresses of life.

Holmes stated that 50% of the athletes who had experienced severe stress in their lives in the year leading up to the football season had injuries that required them to miss 3 days of training or one match, which means they missed significantly more time than playing moderate stress (25 %) and low pressure (9%). This was the aim of this course The aim of this study was to examine the relationship between periods of physical and academic stress and injury restriction by examining injury restriction rates among Division I football players during the 2011 sports season and university semester. We hypothesized that based on stress and injury patterns, periods of high

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academic stress are believed to increase injury rates in these varsity athletes (Mann et al., 2016)

The obtained results confirmed that phases of increased training load are necessary to maximize training adaptations, if only they prevent any form of stress. We have shown that the stressed athlete exhibits several signs of poor training adaptation, associated with increased risk of infection, deterioration of sleep, and onset of cardiac exhaustion. These results are all explanations for the low performance responses of these athletes. In addition, the possibility of creating a method for monitoring cases of athlete fatigue for coaches. By simply measuring the heart rate values under max and/or max effort, recovery heart rate, perceived difficulty of exercise, performance and fatigue felt at rest, it will be possible for a coach to assess the athlete. Fatigue level based on the specific training phase. (Aubry, 2017)

Hence, it has become necessary for us in the future to muzzle the training loads, monitor the indicators of wellness, and try to search for their relationship to the non-contact muscular injuries of the lower extremities among the football players of the Algerian clubs belonging to the second professional national division.

In the light of the previous presentation, the problem can be determined in the form of the following general question:

What are the causes of non-contact muscle injuries to the lower extremities in football players?

2- General objective of the study:

Through this research, we seek to figure out less expensive, less hard and simple ways to muzzle training loads and the responsiveness of footballers to applied training loads. We would also like to study the relationship between lower limbs' non-contact injuries and their relationship to training loads and wellness indicators at different periods of the sports season.

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The importance of research lies in two aspects:

- Scientific aspect:

We will learn about objective and comprehensive scientific methods that will help us to muzzle training loads and monitor the wellness indicators of footballers, and provide them as a reference for future sports training professionals to raise training benefits.

Identification of injury causes - lack of contact - of lower limb muscles, most common among footballers

- Practical aspect:

Applying objective and comprehensive scientific methods that help us muzzle training loads for footballers to reduce sports injuries on the ground.

This study will therefore help us to evaluate the training programmes for the age group that we are going to choose and their relationship with the lower limb muscle failure injuries of footballers.

3- Procedural definition of the concepts mentioned in the research:

-Training load: It is defined by (Soligard et al., 2016) as:

“the sport and non-sport burden (single or multiple physiological, psychological, or mechanical stressors) as a stimulus that is applied to a human biological system (including subcellular elements, a single cell, tissues, one or multiple organ systems, or the individual)”

The search concludes that it is the amount of impact on an individual's different organs during physical activity.

- **Wellness indicators** : It is defined by (W H O) According to the World Health Organization for the evaluation of health programmes; Indicators are defined as “variables that help measure changes”.

The search concludes that they are the players' self-evaluations in specific aspects before the next training

- **Non-contact muscle injuries:** Definition has been provided (Mueller-Wohlfahrt et al., 2013) as: the term tear for structural injuries, graded into (minor and moderate) partial and (sub)total tears, used only for muscle injuries with macroscopic evidence of muscle

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damage (structural injuries). While this classification is most applicable to lower limb muscle injuries.

The research concludes that every obstacle prevents the perfect performance of the muscles to different degrees.

4-Main body:

Injuries, inflammation and under-performance are common problems in high-performance sports. Ball and team sports are the most at risk with football, rugby, basketball, handball and tennis accounting for only 23% of all sports players, yet they account for 76% of all injuries. While the cause of injuries is often multifactorial, and includes both endogenous and exogenous factors, recent research has identified exercise overload as one of the major risk factors for injury related to intense exercise (Gazzano, 2017).

It has become important to monitor the training load and monitor the pro-training effects to prevent overtraining

Training Workloads:

It is possible to define two different types of training workloads: external, and internal (Figure 1). External Workload External workloads are defined as the training features that describe the effort per formed during training or match sessions. Global Position System (GPS) commonly records such features. It is currently the most used system to track the movement of the players reporting information about three main workload features types : (kinematic ; metabolic ; mechanical.)

These features are the most used to evaluate external workloads and to predict the risk of injury.

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Internal Workload:

Internal training workload is usually assessed by evaluating the players' Rate of Perceived Exertion (RPE). RPE is a self-reported scale describing the effort perceived by a player during a physical activity., previous studies showed that TL is a valid method to estimate internal workload, highlighting the fact that this index is strictly related to the players' physiological responses to training stimuli (e.g., oxygen consumption and heart rate) and to external workloads of previous days that are found to be linked to players' fatigue. Another important feature describing the internal workload is heart rate (HR). Even if HR is an important objective index of internal load, the use of heart rate monitoring is not a standardized procedure in soccer teams due to the fact that the chest strap is uncomfortable while performing contact sports .HR data recorded during training and matches are found to be strictly linked to energy expenditure, oxygen consumption, and maximal oxygen consumption, and consequently to internal workload.

Psycho-Physiological Assessment:

Psycho-physiological data includes body composition information, cardiopulmonary assessments, injury history, neuromuscular assessments, players' profile, players' statistics, and psychological assessments

Self-Reported Wellness

Currently, the use of non-invasive and low-cost tools to monitor players' status has become a suitable method of assessing players' response to training and matches stimuli. the relationship between wellness and Internal Training Load in Soccer detecting that the internal training workload is strongly related to the players' wellness status of the next day . Several questionnaires are used in sports to evaluate players' well-being:

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- **Wellness Questionnaire (WELQUE) :**

a 5-point Likert scale of 5 items (i.e., fatigue, sleep, soreness, stress, and mood)

- **Profile of Mood States (POMS) :**

the primary psychological tool for monitoring training stress and over-training syndrome. is composed of questions (i.e., tension-anxiety, depression dejection, anger-hostility, fatigue-inertia, vigour-activity, and confusion-bewilderment) are widely used for assessing mood states among athletes.

- **Daily Analyses of Life Demands for Athletes (DALDA):**

a self-reported questionnaire used to assess life-stress and symptoms of stress in athlete's response to training. DALDA is divided into two sections: (i) self-assessment concerning the general stress sources that occur in the everyday life of an athlete, and (ii) determine what stress-reaction symptoms physically exist in the athlete

- **Total Quality Recovery (TQR):**

a self-reported scale ranged between 6 and 20 in order to evaluate the self-reported recovery status from a previous effort. Values of about 6 refer to no recovery at all, while 20 means that the athlete fully recover.

- **Recovery-Stress Questionnaire for Athletes (RESTQ) :**

this measures the frequency of current stress symptoms along with the frequency of recovery-associated activities. seven stress scales and five recovery scales characterized the RESTQ version for athletes.

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Wearable Devices :

the technological revolution of the last decade, the use of wrist-worn devices (e.g., Apple Watch, Fit Bit, Garmin, and Polar) equipped with heart rate sensors are becoming extremely popular in sports . These devices allow for a complete and objective overview of the users' health status by passively recording semi-continuous heart rate, heart rate variability, blood oxygenation, steps, sedentary behaviours, and sleep quality.

Sports workers and specialists, including coaches and physical trainers, must quantify the training loads in objective ways - simple, inexpensive and comprehensive - that include all aspects that have a direct or indirect impact on the level of sports achievement. (Rossi et al., 2022)

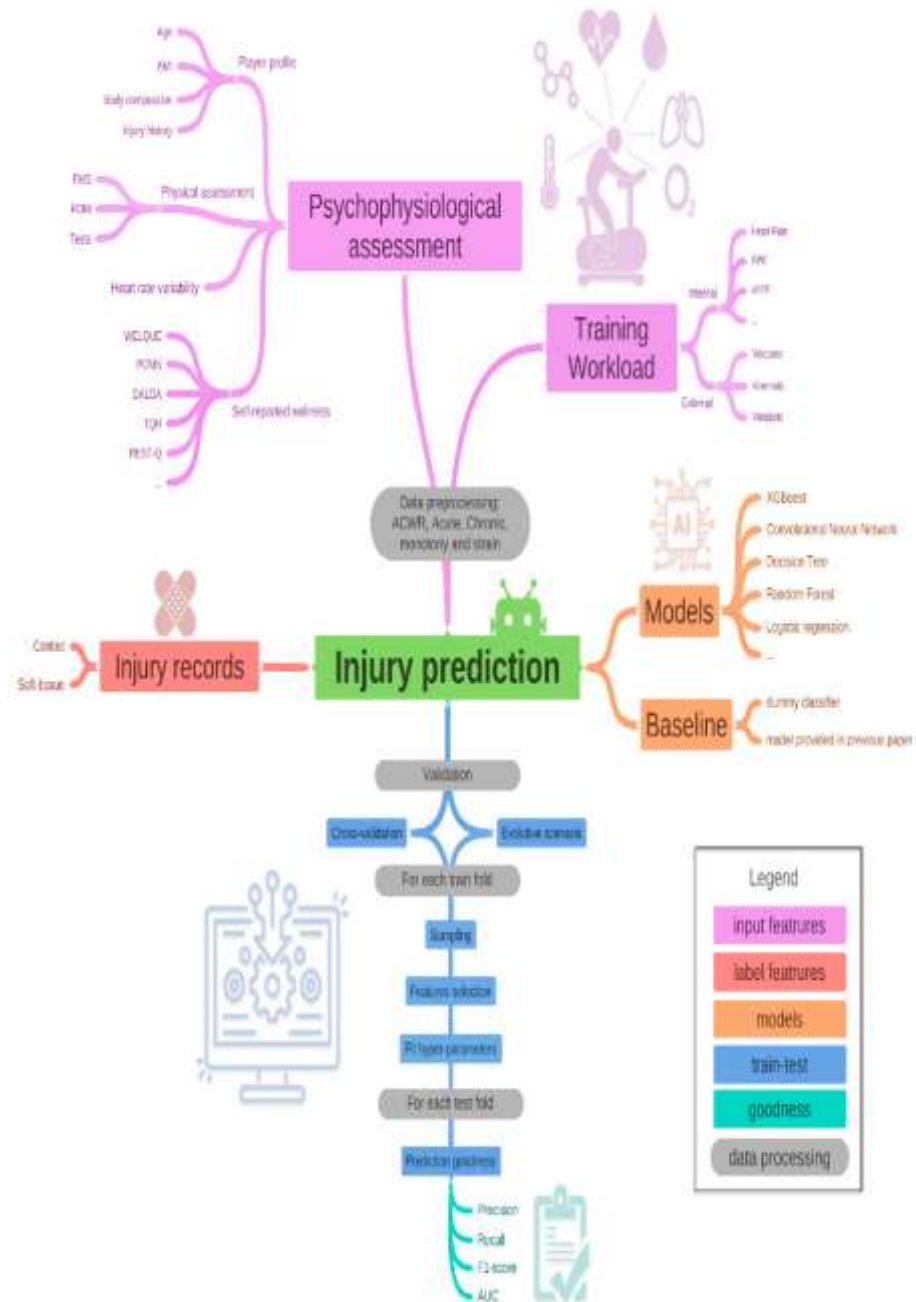
Figure 1:

Diagram of the injury forecasting validation.

The pink leaves (i.e., psychophysiological assessment and training workload) refer to the input variables for the injury prediction algorithm. The red leaf is injury information used to label each training vector. Orange leaves are the models trained and tested by the injury prediction algorithm. Each of these three leaf types (pink, red, and orange) are useful for building the injury prediction algorithm. Furthermore, blue leaves describe how to train, validate, and test the model developed by the injury prediction algorithm. Moreover, green leaves list all the metrics to assess the model's goodness. Finally, gray leaves describe the data preprocessing in each injury prediction algorithm stage.(Rossi et al., 2022)

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Accordingly, the student researcher sees determining the subject of his study in the direction of 'quantifying the training load' The football players in the Algerian clubs of the second national division, as a contribution from us in enlightening the specialists in this most popular game through a study that is based on sound scientific foundations in order to achieve the goals set to reduce sports injuries related to internal pregnancy and because of this positive impact on the progress of the players' level Achieving the desired results

Evaluation and future work:

This systematic review focuses on the monitoring of internal training loads to reduce the risk factors of muscle injuries in adult soccer players, and a better knowledge of how to control training loads by reaching the maximum training load without fear and avoiding the phenomenon of overcompensation, without neglecting the so-called invisible training. In the future, we would like to know the relative training loads with a larger number of Algerian players and analyze all variables related to muscle injuries.

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