What is the A:C workload ratio (…)?

Injuries are a major problem in professional football. A player has two injuries per season on average, which equates to an average of 50 injuries per season for a team of 25 players [1]. One third of these injuries is a muscle injury [2].

In spite of the implementation of various injury prevention programs, the number of muscle injuries remains high in football. Monitoring your players in general and the workload in particular, must be part of an appropriate better injury prevention approach. A U-shaped relationship between workload and overuse injuries indicates that both under and overtraining can lead to a higher injury risk. In addition, spikes in workload should be avoided. This information can provide new insights as well as practical applications provide for periodization and monitor workload [3].

(...) 

External and internal load

Workload management is the quantification of training load during training and competition [4]. Through monitoring, the workload and associated training adaptations can be evaluated. This allows the adjustment or individualisation of workload if necessary, in order to maximize training adaptations and reduce injury risk [5].

In the quantification of workload, both external and internal load are distinguished [6]. The external load is the activity performed by players, and usually dictated by the coach. This load can be measured for example, by means of local (LPS) or global (GPS) position systems, video tracking and accelerometers. Indicators of external load include the total distance covered, distances covered at certain speed zones and the number of accelerations.
The external load causes a physiological response in the body of the player: the **internal load**. A similar external load for two players could result in a very different internal response. This different response is depending on the **individual characteristics** of both players. Examples of individual characteristics include the age, physical fitness level and the training and injury history. The internal load is measured by, inter alia, heart rate monitors, lactate measurements, Ratings of Perceived Exertion (RPE) and training load (i.e., RPE multiplied by the length of the training or competition) [4].

The internal load ensures the eventual training output. This outcome can be **positive** (e.g., an increase in physical fitness), **neutral** (e.g., maintaining the physical fitness level) or **negative** (e.g., a decrease of physical fitness, disease, or an injury). In evaluating the training process it is important to always **relate the training result to the actual physical load** [3].

**Workload and overuse injuries: The U-shaped relationship**

The relationship between workload and overuse injuries has been examined several times in different team sports. Running at high speed is linked to **musculoskeletal injuries** in professional Australian football [7]. These results indicate that a **higher workload causes more injuries**.

On the other hand, also a **shortage of workload can increase injury risk**. Simply reducing the workload to prevent injuries is not the solution. A shortage in training sessions or a lack of activity in competitions can lead to a player not being ready for the requested workload during matches [3].
This can be either a short period, during a workout or contest, or a long-term period during a training camp or due to a busy calendar. A theoretical U-shaped graph displays the relationship between workload and injury risk display (Figure).

This theoretical visualisation indicates that both too low and too high workloads increases the risk of overuse injuries.

**The acute:chronic workload ratio**

In addition to the U-shaped relationship, there is currently also focus on the relationship between the structure of the physical training and game load on the one hand and injuries on the other. Several studies have shown that peaks in physical load of players can provoke an increased injury risk [9-11].

These peaks are lately represented by means of the acute:chronic workload ratio [12, 13]. In this example acute workload is represented as the total load over the previous week and chronic workload is the average weekly load for the previous four weeks, both utilizing an arbitrary unit (Au) which means that different KPI's can be used such as session RPE, High speed running etc [8]. This ratio is suggested as a practice predictor of training-related injuries.

\[
= \frac{\text{Acute workload}}{\text{Chronic workload}}
= \frac{3000 \text{ (Au)}}{4000 \text{ (Au)}} = 0.75
\]

So a ratio below 1, as per the above example, suggests the athlete is more likely to be in a state of “freshness”; their load over the past week has been less than their average weekly load over the past four weeks [8]. On the other hand a ratio above 1 represents that the workload over the past week has been greater than the average weekly load over the past four weeks, so they may be more likely to be in a state of “fatigue” and potentially less prepared for that workload. Recent research has suggested a ratio greater than 1.5 represents a "spike" in workload that is related to a significantly higher risk of injury [8].

*When the A: C ratio is higher than 100%, this indicates that the player’s load was higher during the most recent 7 days (on average) than the last 28 days. If the*
percentage is less than 100%, The player has undergone less workload during last week.

(…)

Conclusion

The acute:chronic workload ratio permits clinicians to quantify a player’s risk of subsequent injury [3]. Periodization guided by daily monitoring can help the prevention of injuries by providing optimal workloads.

Bibliography


