Training loads, hamstring injury risk and occurrence – a case study with reference to **sprinting**

Many teams quantify physical load data from matches using automated camera systems (eg. Prozone), with wearable tracking devices used in training (eg. Catapult). We have previously demonstrated that caution should be applied when using such data interchangeably, particularly for high-intensity and sprinting parameters[1]. With the improvements in player tracking technologies over recent years, we are now able to determine the loads of players in both training and matches using wearable devices, the use of which has been permitted in the Premier League from the 2015/16 season. Therefore, for the first time and in line with other sports, the physical loading of football players in England can be quantified to an accurate and reliable level using one tracking device, and this will improve further as the technology companies develop new ways to improve tracking accuracy inside stadia, where GPS signal can be compromised. Nevertheless, as medical and science practitioners we now have the tools and research base to help manage the physical loading of players to the highest degree possible.

Jan Ekstrand and colleagues[2] have recently reported an increase in incidence of hamstring injuries by 4.1% annually, between 2001 and 2014. An interesting research finding from Chris Barnes and colleagues[3] using automated camera tracking data was the observed increase in sprint distance (+35%) and number of sprints (+80%) in the Premier League between 2006/7 – 2012/13. Sprinting loads and mechanics can be a key factor in hamstring injury occurrence, whether at the maximal net moment in the late swing phase, at push-off, or during the deceleration phase. In fact, Gabbett et al reported that players who performed greater amounts of very high-speed running were 2.7 times more likely to sustain a non-contact soft-tissue injury than players with lower running loads.[4] Therefore we know that players are sprinting more in the Premier League, and that this results in a higher risk of injury, and there has been an increase in hamstring injuries annually in professional football – so how can we best manage the sprinting loads of players? Is it advisable to restrict sprinting loads in training so as not to expose players to an increased injury risk, or conversely does this underprepare them for the high demands of competition, and in particular during periods of fixture congestion?

Recent studies examining training loads and injury occurrence by Tim Gabbett and colleagues[4] have addressed the relationship between a longer time period of work (chronic workload, related to fitness) and a shorter time period of work (acute workload, related to fatigue). In line with traditional principles of training, the 'acute:chronic workload ratio' is one way of determining when an athlete's training load has 'spiked,' which may exceed the normal principles of progression and overload to an extent that the risk of injury in the athlete is increased. The idea is that an A:C Ratio of >1.5 reflects a recent spike in training load compared to the previous four weeks of loading. There is therefore a suggestion that training loads should be consistent from week to week, to enough of a degree to prevent such 'spikes' from occurring, subsequently reducing injury risk. Therefore it could be suggested that players should be given the opportunity to sprint in training on a prescribed and consistent basis, so that the increase in sprinting load from high-intensity matches and a congested fixture schedule can be mitigated.

CASE STUDY

Figures 1, 2 and 3 show the weekly physical loads of Player A over an 8 week period, in which a hamstring injury was sustained in Week 8.

- Figure 1 - Total distance loads were variable but within recommended A:C Ratio levels (0.9 – 1.3)
- Figure 2 - Acceleration loads were around the recommended A:C Ratio levels (0.7-1.4)
- Figure 3 - Sprinting loads 'spiked' in Week 7 with an A:C Ratio of 2.2 (increased injury risk).

In the case of Player A, he played in 2 matches in Week 7 following 4 weeks without any match exposure. During Weeks 3-6, physical loads were accumulated entirely from training, including high distance and acceleration loads from a combination of football and running drills, and small sided games. However, it can be observed that sprinting loads (classed as distance >24km.h) were low-moderate in these weeks, due to a combination of not being selected for games and completing small sided games and high-intensity (not sprinting) running drills in place of match minutes. Consequently, when Player A plays 2 matches in Week 7, a spike in sprinting load occurs which results in an A:C Ratio of >2.0. In theory, had Player A's sprinting loads in Weeks 3-6 been consistent with Weeks 1-2, the overload in Week 7 may not have been to as high a degree and therefore he may have experienced less relative stress on the muscle tissue during these maximal bouts of running.

The individualisation of training loads relative to individual expected match outputs seems the most effective way of mitigating injury risk associated with spikes in training load. Although the literature commonly quantifies external load using RPE derived measures, it can be useful to apply load management techniques to several relevant parameters including sprinting loads, in order to reduce the risk associated with the increasing maximal work efforts from players seen in the Premier League.

References

1. Harley et al., J Str Cond Res 2011 doi: 10.1519/JSC.0b013e3181f0a88f
2. Ekstrand et al., Br J Sports Med 2016 doi:10.1136/bjsports-2015-095359
3. Barnes et al., Int J Sports Med 2014; doi:10.1055/s-0034-1375695
4. Gabbett TJ. Br J Sports Med 2016; 0:1–9. doi:10.1136/bjsports-2015-095788

Figure 1

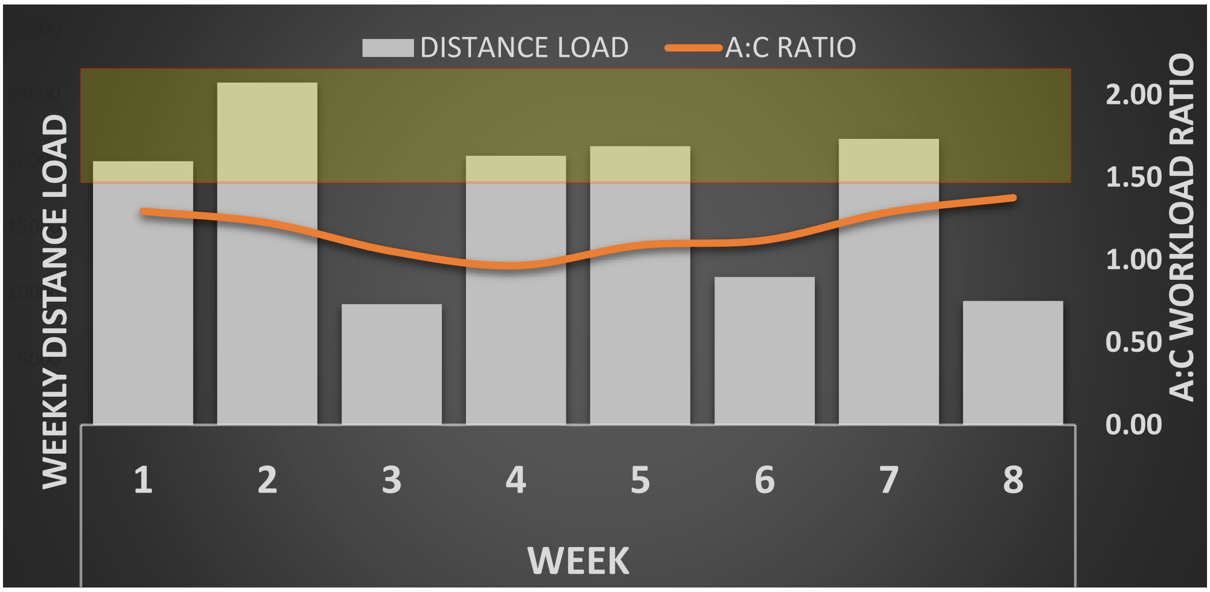


Figure 2

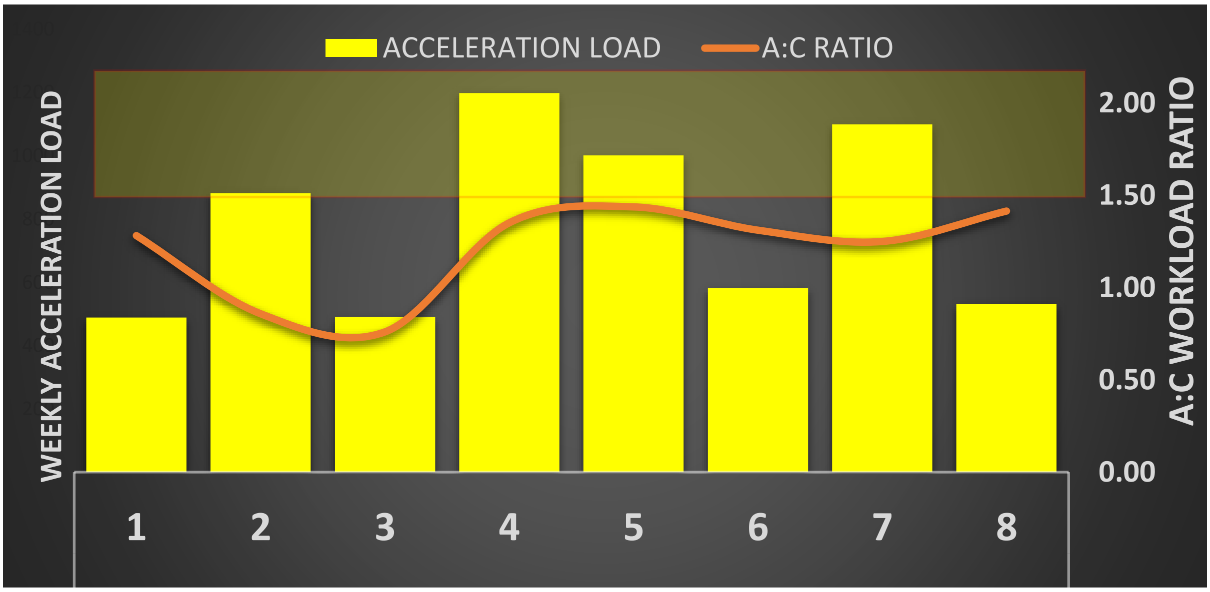
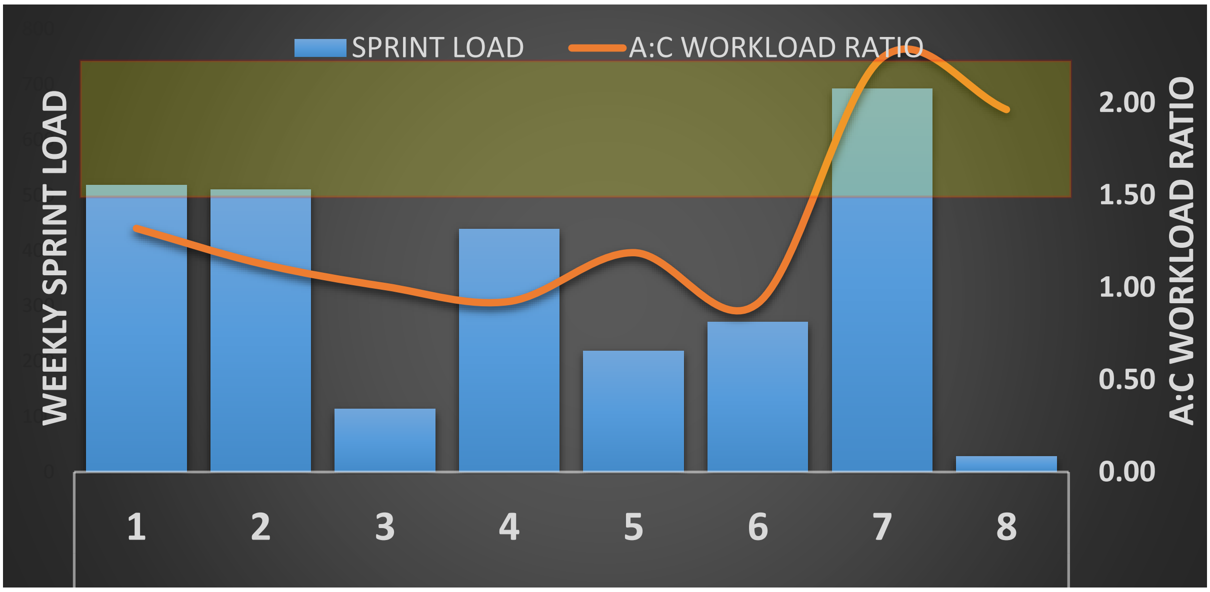


Figure 3


SPRINT LOAD
A:C WORKLOAD RATIO
WEEKLY SPRINT LOAD
A:C WORKLOAD RATIO
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