STRIVE

Effects of Fatigue on Individual's Performance and Muscle Compensation

Introduction

Fatigue is the key driver in exposing weaknesses and deficiencies in athletes' performance. Traditional methods have been inadequate in location weakness points and ensuing compensation when athletes enter fatigue stages. To mitigate further injuries, coaches have been working with players strengthening their muscles in symmetric ways, whether left to right, or posterior and anterior.

To understand this better, we will look at the athlete who conducted six extensive drills as a part of a daily workout. In this example, we will discuss how fatigue affects this athlete and his muscle response during the compensation.

Fatigue Analysis

The athlete ran through set of drills that consisted of running, farmer's walk, obstacle course (running, jumping, climbing), farmer's walk, plate pushing, and monkey bar ramps. Throughout the whole session, the athlete was moving between different parts of the course, actively running. Fatigue was increasing around 10th minute and during the obstacle course.

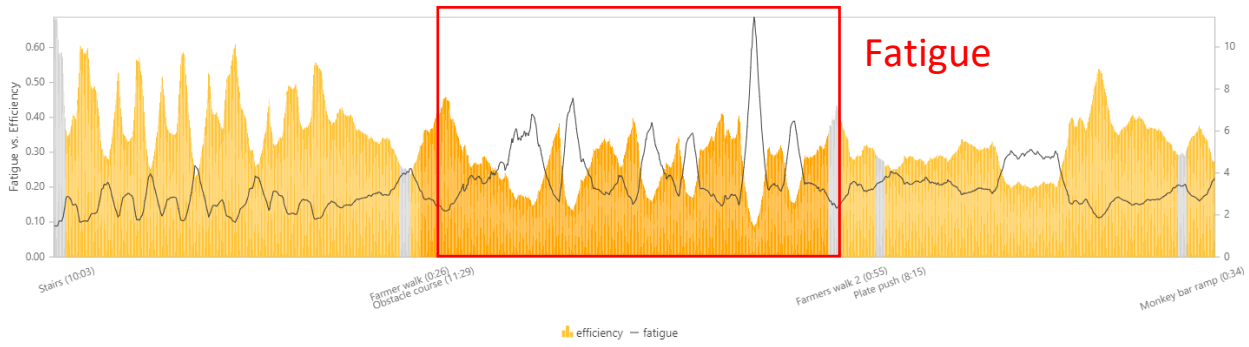

Figure 1 – Fatigue state (in red)

One of the main reasons for the fatigue state have been first 10 minutes of high tempo cardio. Upon their completion, the athlete switched to a lower intensity obstacle course.

Figure 2 – High external load followed by lower external load

As it can be seen in Figure 1, the athlete gets tired after first 10 minutes, which correlates to the completion of the high intensity cardio (see Figure 2). The athlete then gets somewhat recovered during the lower intensity stage, which is the second set of 11 minutes.

In case of Strive, fatigue is defined by the ratio of external and internal load that is unique to each athlete.

Fatigue Outcomes

In this case, looking at the fatigue state (after the red line below) in the Figure 3, this athlete started using quads as his dominant muscles to move. This resulted in lower activation of posterior chain (hamstrings and glutes). The increased utilization of quads of around 27%, and decreased utilization of hamstrings and glutes of about 34%, drove the gap to ~50% increasing the likelihood of knee hyperextension due to the lower activation of the posterior chain. A typical recommendation is that the hamstring should be at least 60% of quads output, which was not the case here. While the athlete did not get injured, the ongoing performance with a similar signature could result in injuries.

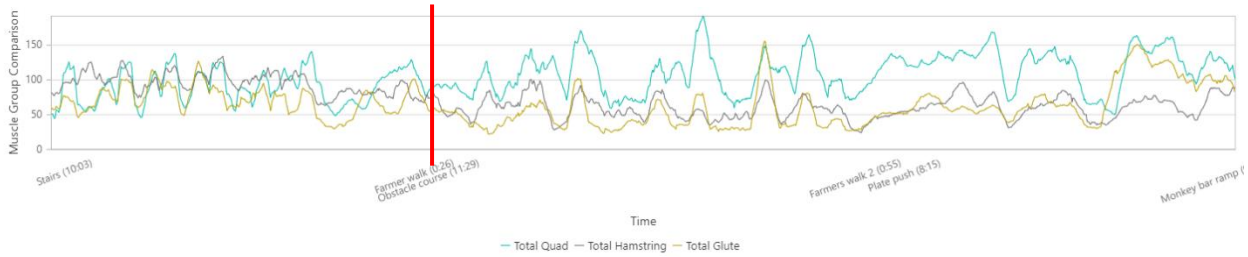

Figure 3 – Muscle compensation during fatigue

Looking at the individual muscles, in this case right quad decreased in output by about 22% forcing the left quad to handle most of the load. Coincidentally, the left hamstring and glute decreased by about 20% in the total exertion from the pre-fatigue state.

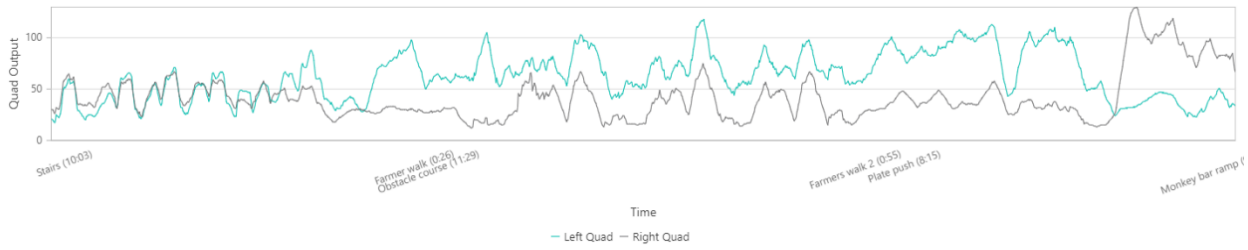

Figure 4 – Quads Output

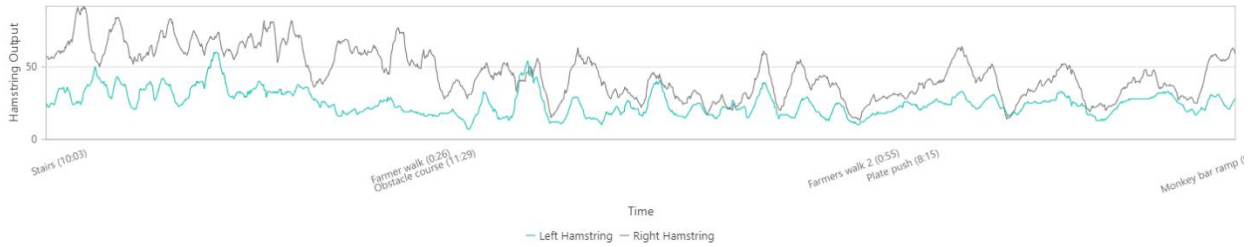

Figure 5 – Hamstrings Output

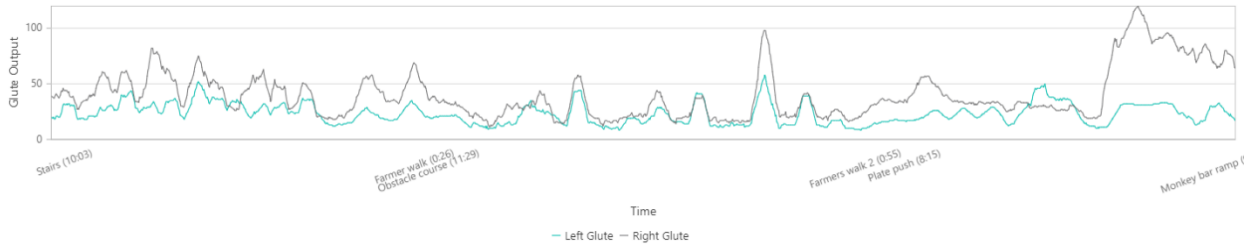

Figure 6 – Glutes Output

Conclusion

Lower limb and the overall performance are very dependent on proper distribution of muscle exertion during any movements. This requires the full balance between quads, hamstrings, and glutes. Often, weight room, and especially static machines have allowed athletes to compensate, and furthermore, present their best version. But things change once the players get on the field, they perform according to their habits, and furthermore, they become their true selves when tired. That is why in this case, we saw the compensation between both, posterior and anterior chain, and left and right (in case of quads).

While fortunately, the injury didn't occur, monitoring this particular athlete on ongoing basis would provide for a better understanding of performance habits, and make sure that the asymmetry does not drift further, but that the athlete gains control over the muscle exertion distribution, even in fatigue states.