THE IMPORTANCE OF STRENGTH TRAINING IN TRIATHLON

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ABSTRACT

Swimming, cycling or running. Which part of triathlon performance is the most important in order to achieve best result in race? Majority of science community is leaning on fact, that despite running is not the longest part of race, it is determining the final result the most. Therefore the aim of this study was to reveal how we could improve running performance in triathlon by improving running mechanics as well as utilizing strength training and plyometry training as training modalities which might be very beneficial for affecting performance in triathlon globally. We are presenting practical guides, exercises supported by science and know-how of many strenght and conditioning professionals. Positive impact of strength training, plyometry training and running mechanics training was found when it comes about improving running economy, maximal aerobic speed, anaerobic treshold, muscle absorbtion and energy utilization ability etc. Simultaneously with these, there were no decreasments in VO2 max, bodyweight or others parameters.

KEY WORDS

Strength, running technique, triathlon

INTRODUCTION

Strength training in triathlon tends to be very neglected due to minimum amount of time available when we consider duration of endurance training. Despite that, strength training should be part of well balanced plan, since thank to that we can improve running economy, which is transfered to less energy consuption, less injuries and better performance. Although swimming and bicycle are part of performance as well, the fact, if triathlete come out from the water on first place with advantage of 20 seconds before 2nd is not determinig overall result. Considering that, our main purpose of this study was to point out on running performance importance in triathlon as well as showing different perspective why running performance is that much important and how we can improve running performance by using different modalities during training. We are presenting impact of strength training to endurance running (absorbtion of impacts, tendon stiffness changes, muscle dysbalances...) as well as emphasis on running technique (improving running mechanics – angles, loading, SSC cycle utilization, muscle activation and also energy saving for examply by hamstring recovery, blood lactate production and breakdown).

„The running portion of the triathlon represents the final leg of the competition and, by some reports, the most important part in determining a triathlete's overall success. Although most triathletes spend most of their training time on cycling, running injuries are the most common injuries encountered. Common causes of running injuries include overuse, lack of rest, and activities that aggravate biomechanical predisposers of specific injuries. We discuss the running-associated injuries in the hip, knee, lower leg, ankle, and foot of the triathlete, and the causes, presentation, evaluation, and treatment of each (Spiker, Dixit, Casgarea, 2012)“. What is confirming our words above.

Because of this fact about overuse injuries in triathlon, we can highly benefit out of appropriate strength training.

Hausswirth, Bigard, Guezennec (1997) did study, where they are presenting, how specific body position on bike can effect running technique and stride length. They report that, the purpose of the present study was to check the increase in energy cost of running at the end of a triathlon and a marathon and to link the decrease in energy cost off running with running kinematic parameters. Seven well-trained triathletes performed 3 experimental trials: a 2 h15 min triathlon (30 min swimming, 60 min cycling and 45 min treadmill running), a 2 h15 min marathon where the last 45 min (IMR) were run at the same speed as the triathlon run (TR) (i.e. 75 % of maximal aerobic speed), and a 45 min isolated run (IR.) done at the same speed. Oxygen uptake (VO2), minute ventilation (VE), heart rate (HR), respiratory exchange ratio (RER) and kinematic data were recorded during the 3 exercise runs. The results confirm a higher energy cost during MR compared with TR (+ 3.2 %; $p<0.05$) and IR (+ 11.7 %; $p<0.01$). The triathlon and the marathon were associated with greater weight loss (1.6 +0.02 kg; $p<0.01$) than the isolated run (0.7 ± 0.2 kg). After cycling, the mean stride length in TR1 was lower during IR1 and increased at the end of TR. The results show that MR led to decrease in stride length compared with IR. After cycling, the triathletes adopted a more forward leaning posture and the trunk gradient was less marked during the marathon. Moreover, the extension of the knee at foot-strike and the maximal knee angle in non-support phase both increased during MR compared with TR and IR. However, it appears that no single kinematic variable can fully explain the decrease in running efficiency: it seems that running economy during a triathlon and a marathon are linked to global alterations of many different.

After we got to know, that running is the most important part in triathlon and both prior running disciplines swimming and biking are negatively effecting running technique, we are about to go more deep into case of running injuries.

In this problem made big study McHardy, Pollard and Fernandez (2005), where they present that the run is the final leg of the triathlon and this part is the most important. Epidemiological studies reveal the majority of triathlon injuries occurred during running and may be due to the high impact loads the legs and feet experience while pounding on the road (Cipriani, Swartz, Hodgson, 1998). McHardy, Pollard and Fernandez (2005) countinue that with the accumulative effects of the previous two legs, the triathlete can be under a moderate amount of both physical and mental stress. Hence, there is a greater chance of sustaining fatigue-based injuries, particularly in longer events (Kerr, Trappe, Starling, 1998) what we consider as natural.
Cipriani, Swartz and Hodgson (1998) are adding, that in shorter events, epidemiological investigations revealed the incidence of running injuries in triathlete is similar to that of nontriathlon runners. Following the cycle leg, lower limb muscle fatigue can result in a decrease in speed of contraction and peak force of muscle fibers, particularly the plantar and hip flexors from the swim and bike legs, respectively.
With respect to the cycling leg, often there is a build up of local lactate in the thigh due to the bike leg being non-weight bearing and the legs being used heavily in a limited range of motion. At the start of the run leg, muscles are most likely unable to produce the same amount of power as would otherwise have been the case if the run leg had been performed first. The result is a decreased stride length, yielding a slower pace and a subjective feeling of a harder run (Hausswirth, Bigard, Guezennec, 1997)
Collins, Wagner, Peterson et al. (1989) are adding the most related fact to our theme, which is that in training, running overuse-related injuries frequently affect the lower extremity. These include patello-femoral pain, iliotibial band friction syndrome, Achilles tendinosis, stress fractures, compartment syndrome, tibial periostitis and plantar fasciitis. These conditions are the result of a combination of factors including the type of training undertaken, footwear utilized and running biomechanics.
From above mentioned facts it is clear, that we need to focus so much to running injury prevention and related strength training.

Since part of this study is also to offer different perspective and know-how guide how we would manage strength training in triathlon, how we would improve running technique and how we would implement above mentioned adjustments here are practical examples of exercises and WHY behind them. All of these strategies were achieve thanks to Elite Performance Institute certification courses that we had been participated. Presented information are sources of elite strength and conditioning coaches who spent decades by training elite athletes in various sports disciplines and they shared their knowledges for what we are cordially thankful.

1. Movement pattern

The better running technique, the better running economy can be seen. It means that in order to improve running technique we are watching following key points presented in **Figure 1.**

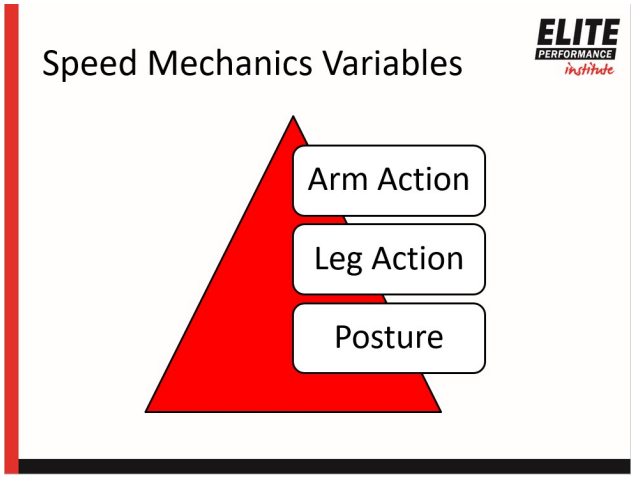

Figure 1 EPI running mechanics variables for analysing (Gilligan, 2018)

We should always start with the posture. When it comes about analysing running mechanics we are using very simple mobile apps for example Hudl technique where we can easily from video observe correct lines, angles and trajectories. When it comes about posture, all we would like to see is upright body posture. The rest depends on running speed.
During legs work we are concentrating to improve active heel recovery from backside and high thigh position on front side as well how initial contact ground is happening. When it comes about endurance run, arm should move smoothly and close to the body for minimal energy consuption and maximal stabilization of trunk. For better interpretation see **Figure 2.**

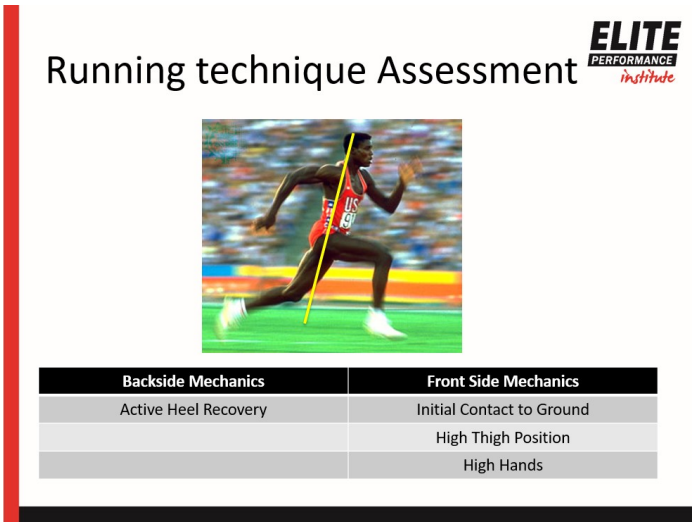

Figure 2 EPI´s example of coaching observation during running (Gilligan, 2018)
Movement pattern can be learnt with appropriate step by step approach exercises, here is the list of few wall drills that can be used by 20:80 Parreto principle – 20% of exercises which will bring 80% of technique correction. Most of these drills are using a help of wall support in order to achieve correct biomechanics (angles, trajectory of joints etc.)

Figure 3 EPI´s example of coaching running technique through wall drills
Fernandez-Reveles et al. (2018a, 2018b) found, that running phase is the most influental part of triathlon result among all 3 parts of triathlon race despite its shorter duration. Swinnen et al. (2018) revealed that it is possible to enhance running economy by specific running training, but more important that specific running training also improve cycling economy, which could be considered as a reason why running training should be prefered instead of cycling during preparation for race. Cycling specific training did NOT improve running economy, only cycling economy therefore it is less convenient. When it comes about running economy Saunders et al. (2004) declare, that STRENGTH TRAINING and high altitude training are 2 of the most important modalities for improving running economy. We agree, that strength training allows the muscles to utilise more elastic energy and reduce amount of energy wasted in braking forces.

2. Strength training for improving running

Strength training is very wide training modality often neglected by endurance athletes, because they think, that it is not needed for their endurance performance.
The fact is, that strength training is very beneficial for endurance athletes, but they need first to underestand it's why.

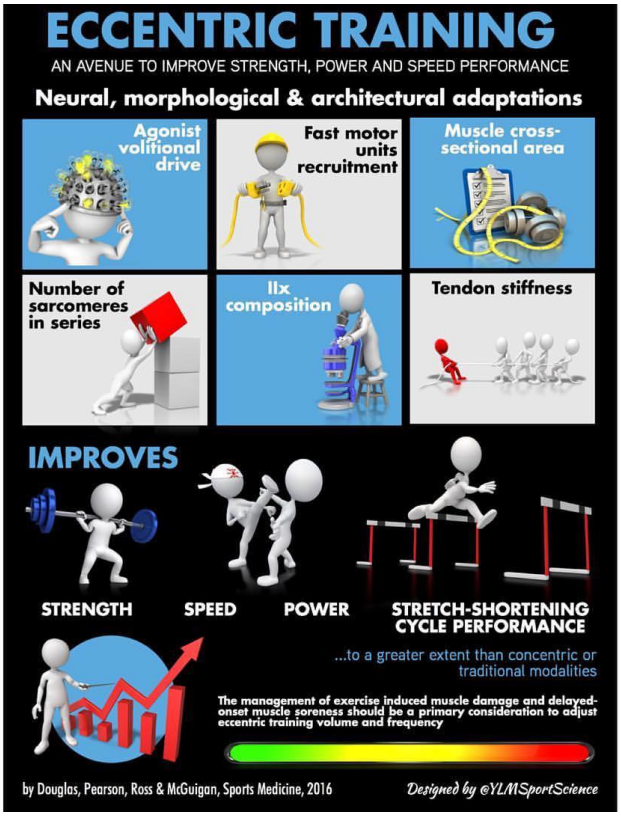

Figure 4 Eccentric training as training method for improving running

Figure 3 is presenting, that one of the best training modalities for improving tendon stiffness which is transfered to better utilization of elastic energy and reduction of energy wasted in braking forces = improving running stride economy. Johnston et al. (1997) compared effect of endurance only and strength training + endurance training on running economy and performances. They found significant improvement in performance after combined endurance training supported by appropriate strength training without any decreasment in VO2 max. parameter. Similar findings were presented by Storen et al. (2008), since they found maximal strength training as very beneficial when it comes about improving running economy, time to exhaustion at maximal aerobic speed with no negative impact to VO2 max or bodyweight.

3. Plyometry for improving running

From EPI training system by Karl Gilligan (2018) we know, that we have two types of stretch and shortening cycles (SSC) wich are slow and fast. Exercises for slow SSC development are concentric dominant what means, that it will be more beneficial for athletes who's sport includes a lot of jumping, acclerations and change of directions. On the other side fast SSC based exercises are more beneficial for maximal speed development, or pace running.
Saunders et al. (2006) found significant improvement in running economy and running mechanics after 9 weeks lasting plyometric oriented training program without negative impact to cardiorespiratory measures.
For increasing running speed and running economy we can in our programs use for example: Rebound tuck jumps (5-10m), rebound hurdle jumps (low-low hurdles/low-high/high-high), depth jumps, stiff leg single leg hops, sprint cycle single leg hops etc.

CONCLUSION

Otoole et al. (1995) found strong correlation between running economy and triathlon performance in elite triathletes. Since a lot of triathletes are ex competitors in swimming it is important to note, that there is strong correlation between running economy and VO2 max, anaerobic treshold, ventilatory treshold performances so not only swimming is the important part of triathlon race but running seems to be even more important in order to achieve best race result. Our study showed different perspectives on triathlon training and emphasized on importance of strength and plyometric training as well as running drills if we want to achieve better running economy and performance which will lead into significant improvement during race overall.

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