



TESTING EXPLOSIVE STRENGTH AND SPEED IN ENDURANCE ATHLETES MAY HELP TO IMPROVE THE PERFORMANCE IN RUNNING EVENTS

INTRODUCTION

It is well documented that the main physiological prerequisites for success in endurance events are VO_{2max} , lactate threshold and running economy (in running events). In elite athletes, the VO_{2max} has been found to be the dominant factor of success in endurance events.

Traditionally, the training in endurance events such as long distance running and cross-country skiing has been targeted to improve the function of the cardiorespiratory system to increase the VO_{2max} , aerobic and anaerobic thresholds. There has been little attention to the anaerobic performance ability in endurance events.

It is well documented that explosive strength and speed training cause specific adaptation to the neuromuscular system improving explosive force production ability such as rate of force development, increased rate of activation of motor units, improved anaerobic energy production and neural adaptation.

When endurance athletes (runners, cross-country skiers) have engaged in explosive strength and speed training, it has been found that the endurance performance was improved significantly. Also, it has been noted that endurance athletes performing well in explosive strength tests outperformed their fellow athletes in endurance tests.

SUPPORTING EVIDENCE

Paavolainen et. al. (1991) reported that national level cross-country skiers who engaged in explosive type strength training in addition to their normal training, were able to improve their force-times i.e. improve their ability to produce a given amount of force in shorter time. This was also described by a significant improvement of jump heights in both static and counter movement jumps, whereas their counterparts in control group did not. The authors concluded that the explosive type strength training is beneficial to the cross-country skiers, which improves their force production ability without reduction in aerobic capacity.

In another study, Paavolainen et. al. (1999) studied the effects of explosive-strength training on 5-km running performance. In this study, the endurance athletes (elite orienteers) were able to improve their 20-m sprint time, 5-jumps and maximal isometric force in leg extensors as a result of explosive-strength type training. What was interesting, these athletes were also able to improve their 5-km running time significantly. The researchers concluded that simultaneous explosive-strength type training including sprinting and endurance training improves the 5-km running performance possibly by improving the neuromuscular characteristics, which were transferred into improved muscle power and running economy!

Sinnett et. al (2001) studied the relationship between anaerobic power tests and 10-km running performance. They found out that explosive strength characteristics such as static jump, counter movement jump and plyometric leap showed significant negative correlation with 10-km running performance. This means that the better the explosive strength performance, the better is the running performance. Furthermore, both the 50-m and 300-m sprint times correlated significantly with the endurance performance. Sinnett et. al concluded that a significant relationship between explosive strength performance with 10-km performance!



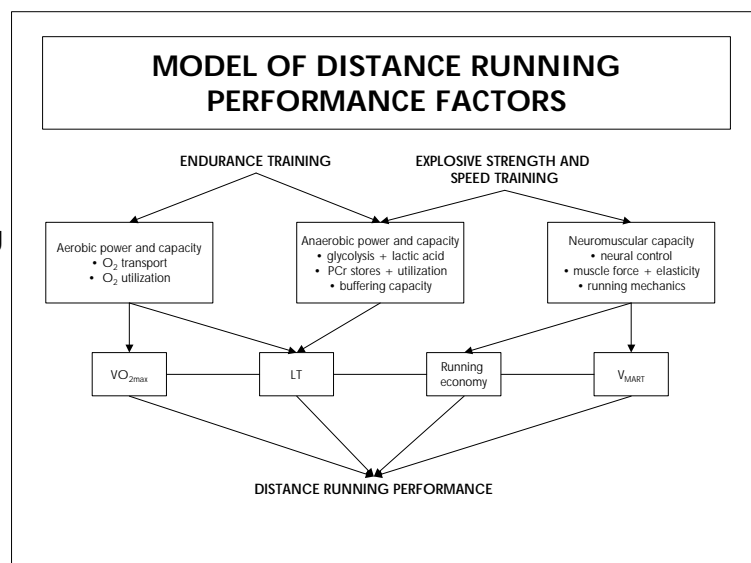
Turner et al. (2003) had studied the improvement in running economy after 6 weeks of plyometric training in recreational athletes. They found out that the plyometric training in training group improved the running economy 2-3 % compared to the control group. They did not find differences in explosive strength characteristics between the groups. According to the authors, the plyometric training was quite moderate and was not aimed to improve the vertical jumping ability.

Spurrs et al. (2003) also studied the effect of plyometric training on distance running performance. The 6-week plyometric training was found to improve significantly CMJ height, 5-bound leap test and lower leg musculotendinous stiffness compared to the control group. The 3-km performance time in training group improved by 2.7 % as a result of plyometric training. The control group did not improve their performance. The training did not improve the VO_{2max} , therefore, the researchers concluded that the plyometric training improved the musculotendinous stiffness in lower leg muscles, which, in turn, led to the improved running economy and improved 3-km running performance.

SUMMARY

The performance in endurance event (running events especially) is based on the VO_{2max} , lactate threshold and running economy (economy of locomotion for example skiing). However, endurance performance is not solely related to oxygen transport and use. Several neuromuscular factors of force production ability also play a very important role: muscle contractility, ability to utilize the potential energy stored in muscle structures during the pre-stretch of the run cycle i.e. the stretch-shortening cycle (SSC), force-time characteristics of the muscles.

These characteristics can be improved significantly with explosive type strength training in endurance athletes as in power athletes. These improvements may, then, be transferred to other performance factors such as improved (shortened) ground contact time, improved anaerobic energy production, improved force production during the running gait cycle leading into improved running economy. The speed training is shown to improve the submaximal movement (running) velocity and running economy, which in turn also helps in improving the endurance performance.



The interaction of distance running performance (Paavolainen et. al., 1999)

According to Di Pampero et al., 1993) a 5% decrease in the energy cost of running results in 3.8% improvement in distance running time. An example: an athlete's time in 5000-m race is 13.47, after the training and improved running economy the improvement may be as significant as 31.43 s with time improved to 12.96!



HOW TO MEASURE THESE PERFORMANCE FACTORS?

Newtest Powertimer testing system offers a versatile and extremely accurate tests in order to test and measure these performance factors also in endurance athletes. The Powertimer tests include speed/explosive strength tests such as

- static jump (SJ),
- counter movement jump (CMJ),
- drop jump (DJ) and
- reactivity-stiffness test.

Anaerobic power can be measured with three different protocols: Margaria's stair run test, repetitive jump test or RAST. Furthermore, the speed testing capabilities with photocells can be used to test the athlete's running speed for a given distance. The test data is analyzed and stored in Powertimer Analyzer database. This database software offers a very powerful tool to analyze the athlete's performance by comparing to previous test results or even with other athletes tested! More info at www.newtest.com.



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