IT'S ALL IN THE MUSCLE

I have written a number of short articles most of which are condensed versions of the works of various experts in the field of exercise science and biomechanics.

Although there is no specific data to decide the best method of training, in many of my articles I have quoted creditable opinions and physiological reasons for recommending race-pace training in preference to long over-distance training, especially for events of 50 metres to 200 metres, which make up a total of 12 Olympic events. Most of these events take a time of less than 2 minutes.

In the following discussion I would like to support my preference for race-pace training, and look at present thinking about certain aspects of training.

Types of muscle

"When considering the pros and cons of training muscles to perform specific tasks, it may be well to consider briefly the types of muscle. It is established that we have red slow-type 1 fibres and white fast type 2 fibres. There also are five sub-types of the white fast-type 2 fibres.

Some of these fast sub-type 2 fibres are uncommitted fibres – they can develop into slow or fast type fibres depending on the training intensity. Long over-distance training will develop slow- type fibres and fast race-pace swimming will develop fast- type fibres.".*

Physiology of training

"There are two methods usually considered in training, either by performing more contractions in a given time period (increasing intensity) or by maintaining the same frequency of contraction for a longer period (increasing exercise duration) In studies lasting up to twelve weeks, enzyme concentrations appear to show a gradual and progressive increase. At present it seems that the rate and magnitude of these changes is a function within limits of the total amount of muscle contractile activities.

As will be discussed, it seems the former method of increasing exercise intensity may produce more rapid and greater results than the latter, but at a greater risk of overtraining……..

The first practical point of this research is that there is a limit to the extent to which the mitochondrial enzyme can adapt and this limit is reached more quickly, with less total training time, by performing high-intensity exercise of short duration than by running/swimming at much lower intensities for very much longer.

What practical value can be derived from this knowledge? Firstly, mitochondrial adaptations to training only occur in the trained muscle and then in muscle fibres that are active during these specific exercises. This indicates that when training for a particular event or sport, an athlete must concentrate on utilizing the correct muscle groups, and, more specifically, the appropriate muscle fibres and the metabolic pathways in those fibres.

This wisdom underlies an important principle of training, known as the *'specificity of training."* *

Types of training

"Sustained long distance short-rest swimming results in the swimmer swimming 'tired' and if you are always swimming with tired muscles those tired muscles will be recruited in a different way which will not prepare the muscles for race- pace swimming; it is widely accepted that distance swimming reduces the speed of sprint swimming. We are also finding that the brain reduces its muscle recruitment progressively during exercise as well – reasons unknown – and that this causes the fatigue of prolonged exercise…..

I am beginning to think that fatigue is perceived in the brain and is a learned response - that is – we programme ourselves to fatigue at a certain time during exercise. This is another reason why high-speed training is so important, it trains the brain as much as anything else." *

The practice of limiting the recovery time in over-distance short- rest sets uses oxygen on a 'pay as you go' basis, this limits the speed of the swimmer so it is not possible to swim at race pace or faster than race pace. The rest interval has to be long enough for the swimmer to be able to continue at race pace; this would train the muscle to access the substrates and oxygen used by the fibres at fast pace for the duration of the distance to be swum,.thus maintaining race-pace is more important than the rest period. The intensity of race-pace swimming also increases the buffering capacity of the muscle by 30-50% allowing the swimmer to maintain the fast pace for a longer period.

Often the term 'aerobic base' is mentioned as some sort of prerequisite for all types of training. It is not clear what this means in terms of muscle function, the concept suggests that a base is built that will stay intact while you perform all types of training. In fact, the muscle will always respond through fibre changes to whatever intensity you are training, always leaning towards the predominant stimulus of your training.

Athletics parallel

Athletics has been well ahead of swimming in training methods, possibly because it has always been financially rewarding, has a very popular following and has attracted big sponsorships providing much scientific research. Interval training was introduced by athletics and adopted by swimming coaches, so it is worth while to keep an eye on what they are doing.

In a recent scientific study in the ***Journal of Applied Physiology*** workers demonstrate that by reducing the volume of training by 25% and introducing the so-called speed endurance training (6-12 x 30 second sprint runs, 3-4 times a week) endurance trained runners can improve not only short-time but also long term performance.

Runners improved their 10-km time by 1 minute - from 37.5 to 36.3 minutes after just six weeks of changed training. Six of the participating 12 runners obtained a new personal record on the 10-km, despite having been training for more than 4 years. The most impressive achievement was the one runner who lowered the time by more than 2 minutes from 37.5 to 35.4 minutes. In addition, performance in a 50 sec sprint test and an intense exhaustive run (about 2 minutes) was improved by 7% and 36% respectively. In agreement, the authors have previously shown that an 85% reduction in training volume can improve short-term performance.

In association with the improved performance the amount of muscle Na+/K+ pumps was elevated and the rate of accumulation of potassium during exercise was lowered, and it is speculated that this may play a significant role for the increased performance"

Conclusions

I believe that the foregoing study and many others show the value of race-pace training and should be given a lot more thought and practice by coaches to enhance their knowledge and experience other than the long distances and time consuming routines that many follow. "It is difficult to understand how training at speeds that are markedly slower than competitive pace for 3-4 hours a day will prepare the swimmer for the supramaximal efforts of competition." **

The danger in all swimming programmes is overtraining; testing not properly followed, the swimmer gets tired, and performance suffers. It is of no use persisting with a particular model of training if improvement is not an ongoing result. Scientific testing is a most valuable indicator.

Records of the past and present confirm that swimming is getting faster every year and it will be even more of a challenge without the 'rocket suits'. Coaches will need to experiment with methods to find the speed their swimmers will have to have to stay in the race – the answer may be here.

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