

## Food for thought – train low, compete high

Not to be confused with ‘train high, compete low’ (which refers to altitude), training with low carbohydrate levels and competing with high levels has been referred to recently as a new strategy. The landmark studies that initiated this strategy are relatively recent (2005 and 2007) compared to our knowledge of the essential role of carbohydrate as fuel.

The first of these investigations is known as the ‘one legged cycling’ study. The subjects undertook a training schedule in which one leg cycled twice a day, on alternate days, whereas the other leg cycled daily, once a day. Both legs did the same total amount of training. Needless to say, this all took place in a laboratory!

Everyone had a high carbohydrate diet during the study. The purpose of the study was to look at the leg muscle training adaptations resulting from the cycling and it was a clever design in that each person’s legs could be compared with each other as their nutritional status would be the same. The once a day training regime allowed the leg to recover its muscle glycogen stores and therefore train in a ‘high carbohydrate’ state. The twice a day regime meant that the second training session was undertaken in a ‘low carbohydrate’ state as the muscle glycogen stores were not fully recovered.

The investigators found that the leg that had done the twice a day training, and had therefore trained in a low carbohydrate state, had a higher muscle glycogen level after exercise than the level seen in the once a day leg. Also, the twice a day leg was able to exercise for twice as long as the once a day leg. The results indicate that training adaptation of the leg muscles and the endurance performance were increased significantly more after the ‘low carbohydrate’ training, compared to the ‘high carbohydrate’ training.

The initial study was conducted with untrained individuals but a further study, in 2007, used well-trained subjects, reasoning that they would already have maximised their training adaptation. This latter study used interval training protocols, rather than one legged cycling, to create the low and high carbohydrate conditions. Again, metabolic markers of training adaptation and the endurance performance were higher in the ‘train low’ group. However, it was also clear that the ‘train low’ group perceived their performance test as being much harder and this effect has been replicated in subsequent studies.

More recent studies have looked at a range of metabolic markers and the pooled results suggest that training programmes of 3-10 weeks, in which some sessions are undertaken with low carbohydrate stores, will increase carbohydrate and fat metabolism levels and mitochondrial activity. Mitochondria are the powerhouses within muscle cells which produce the components needed for the cells to do work (i.e. to exercise) and to use fat store efficiently as fuel.

So, what does this mean to us, as cyclists or runners? First of all, results from cycling studies such as those described above are accepted as being applicable to runners because both sports are endurance based. (And it would be rather difficult to design a one-legged running study!)

The 'train low' refers to the body's levels of glycogen (fuel stores) rather than to the overall diet, a high carbohydrate diet is still recommended for endurance sports.

The studies suggest that undertaking some training sessions when carbohydrate levels are relatively low, such as training before breakfast, will enhance training adaptations and improve overall performance.

It is also likely, however, that the 'train low' sessions will feel particularly difficult and that we may find ourselves running more slowly than expected. This is a difficult area in which to know what to expect as muscle adaptation and metabolism are not the only factors determining performance; perception of effort and fatigue involves the whole body and particularly the central nervous system.

The 'train low' sessions should sensibly not be high intensity nor our longest sessions. We should aim for medium distance and moderate intensity in these training sessions.

When we race we should always be in a 'high carbohydrate' state. The training adaptations that have been achieved will mean that we are better able to use fat as a fuel and to save the muscle glycogen for the parts of the race when it is needed most.

More is not always better: doing all training sessions in a 'low carbohydrate' state won't further increase the training adaptations and it will not prepare our muscles to make best use of carbohydrate fuel (glycogen) during the race. So, the recommendation is to choose shorter training sessions for 'low carbohydrate' days and longer ones for 'high carbohydrate' days when we have fully restored our body's glycogen levels.

Don't be misled by people who substitute the term 'fasted training' for 'low carbohydrate'. It has been shown that eating a pre-training meal or snack based on protein and fat, rather than carbohydrate, does not negate the benefits of 'training low'. So, you could breakfast on scrambled eggs, and tea or coffee, and still be in a 'low carbohydrate' state when you train.

In addition to exercise feeling more difficult, there are other reasons not to train exclusively in the 'low carbohydrate' state. It can lead to increased muscle protein breakdown and compromised immune function in the longer term.

Finally, there's no substitute for training. Nor is there a short cut to achieving a good nutritional base for that training, however nutritional strategies such as 'train low, compete high' can enhance our training when undertaken as part of a healthy, high carbohydrate diet.

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