Carbohydrate Loading (Supercompensation)

Carbohydrate loading is a special practice that aims to maximize or “supercompensate” muscle glycogen stores up to twice the normal resting level (e.g., ~500–900 mmol/kg dry weight).

The first protocol was devised in the late 1960s by Scandinavian exercise physiologists who found, using the muscle biopsy technique, that the size of pre-exercise muscle glycogen stores affected submaximal exercise capacity. Several days of a low-carbohydrate diet resulted in depleted muscle glycogen stores and reduced endurance capacity compared with a mixed diet. However, high carbohydrate intake for several days caused a “supercompensation” of muscle glycogen stores and prolonged the cycling time to exhaustion. These pioneering studies produced the “classical” 7-day model of carbohydrate loading. This model consists of a 3- or 4-day “depletion” phase of hard training and low carbohydrate intake, followed by a 3- or 4-day “loading” phase of high carbohydrate intake and exercise taper (i.e., decreased amounts of training).

Early field studies of prolonged running events showed that carbohydrate loading enhanced performance not by allowing the athlete to run faster but, rather, by prolonging the time that the athlete could maintain the race pace.

Further studies undertaken on trained subjects have produced a “modified” carbohydrate loading strategy. The muscle of well-trained athletes has been found to be able to supercompensate its glycogen stores without a prior depletion or “glycogen stripping” phase. For well-trained athletes at least, carbohydrate loading may be seen as an extension of “fuelling up”—involving rest/taper and high carbohydrate intake over 3 or 4 days. The modified carbohydrate loading protocol offers a more practical strategy for competition preparation by avoiding the fatigue

and complexity of the extreme diet and training protocols associated with the previous depletion phase. Typically, carbohydrate loading postpones fatigue and extends the duration of steady-state exercise by approximately 20% and improves performance over a set distance or workload by 2 or 3%