FAT AS FUEL FOR PHYSICAL PERFORMANCE

Text: Nicki de Villiers, Registered Dietitian, hpc & Slava Radkeva

Should we change from carbohydrate?

Dietary manipulation is a common ergogenic strategy used in attempt to improve performance. No single strategy can be accepted for all athletes in all sports, however convincing support for a moderate to high carbohydrate diet.

The use of high fat diets in contrast to a high carbohydrate intake are usually not well accepted by athletes due to reported negative consequences such as a slower gastric emptying, higher ratings of perceived exertion during exercise and an inability to sustain high intensity training regimes.

Attempting to clarify whether high-fat or high carbohydrate diets improve performance one must consider a range of factors such as the nutritional status of the athlete, the period of diet manipulation, the conditioning of the athlete as well as the type of activity engaged in to name a few.

The question:
"What is the best source of energy that would prevent fatigue and prolong performance?"

FAT vs CARBOHYDRATES

Carbohydrates in an athlete's diet are important because they replace muscle glycogen used during training as well as maintain steady blood glucose levels to prevent fatigue. If blood glucose levels are not maintained steady and within the norms, the athlete's intensity of exercise will decrease.

Fat does contribute to the athlete's energy pool over a large range of exercise intensities. The fat is metabolized at more or less the same absolute rate irrespective of the exercise intensity but the proportion of the energy contributed by fat decreases as exercise intensity increases and therefore, the contribution from carbohydrates increases.

The current recommendation therefore is that an athlete's snack or meal prior to exercise should:

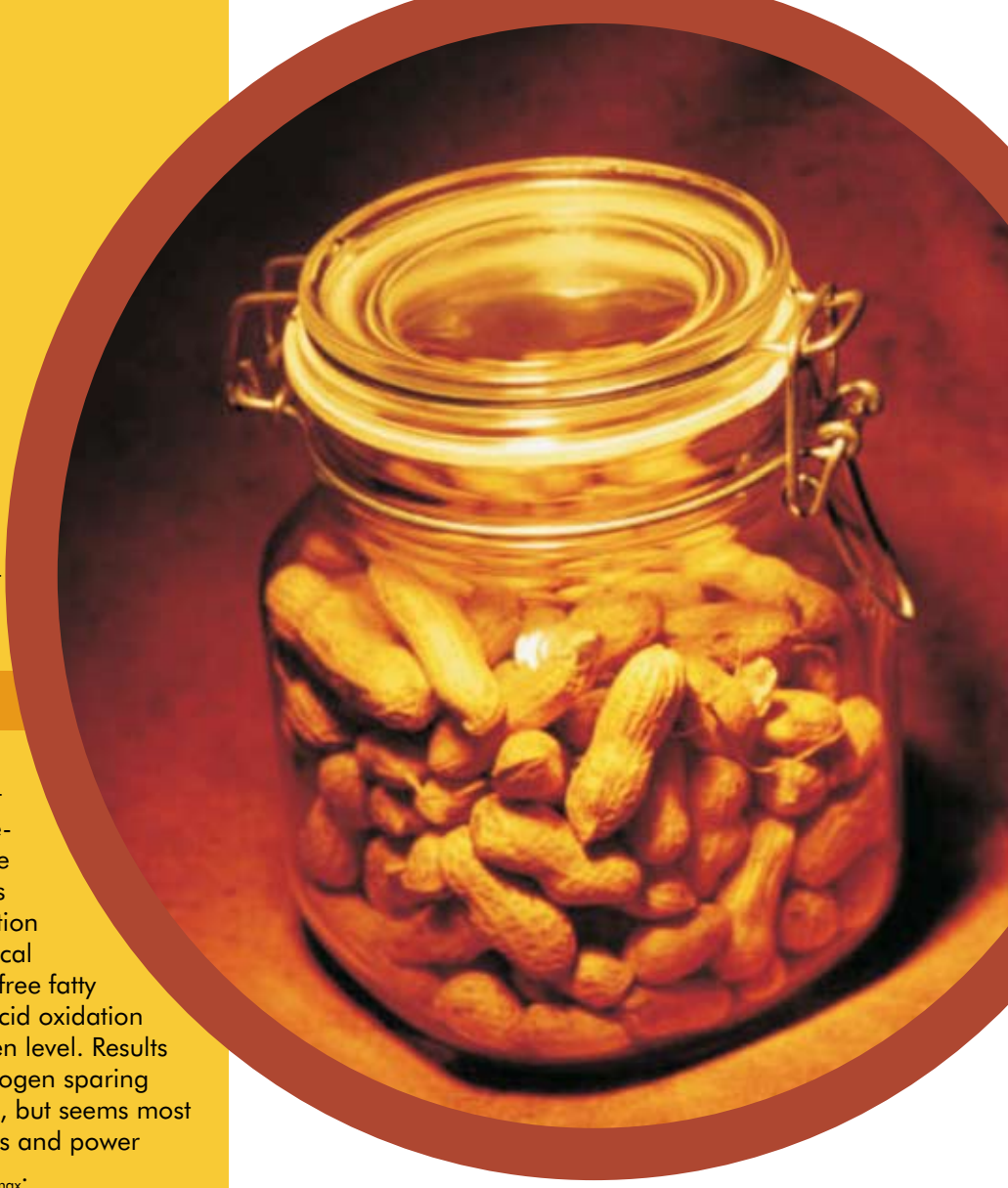
- Provide enough fluid to prevent dehydration
- Be low in fat and fiber in order to facilitate gastric emptying and minimize gastric discomfort during training
- Be high in carbohydrates to maximize maintenance of blood glucose
- Be moderate in protein content
- Consist of foods that are familiar to the athlete as well as well tolerated by the athlete

After exercise it is recommended that an athlete consume a mixed meal that provides protein, carbohydrates and fat.

In summary, consumption of excessively large quantities of protein and fat in an athlete's diet should not be encouraged because they may displace the carbohydrate rich foods within the athlete's energy requirements. High amounts of fats and proteins in the diet may also lead to gastric discomfort and may indirectly interfere with the glycogen storage of the athlete by preventing sufficient intake of carbohydrate rich foods.

FAT LOADING

As endogenous carbohydrate reserves are limited, glycogen depletion often coincides with fatigue during endurance and team sports. Due to glycogen depletion there has been a recent surge of interest in several nutritional practices which in theory could promote



fatty acid oxidation to spare glycogen stores and result in improved exercise capacity. These theories include ingestion of fat and caffeine before exercise, chronic adaptation to high-fat diets and L-carnitine supplementation to name a few.

Caffeine Ingestion before Exercise

Caffeine is a pharmacological agent used by many athletes to improve short high-intensity and prolonged moderate-intensity exercise performance. Caffeine has direct effects on the central nervous system resulting in a decreased perception of effort. Caffeine also poses a theoretical possibility of increased mobilization of free fatty acids with subsequent increased fatty acid oxidation and a sparing effect on muscle glycogen level. Results of various studies indicate that this glycogen sparing effect of caffeine is a variable response, but seems most likely to occur with larger caffeine doses and power outputs eliciting greater than 70% VO_{2max}.

Fat Feeding before Exercise

Several studies have investigated the effects of fat feeding before exercise. It seems that fat feeding, in combination with intravenous heparin increases lipolysis with a greater availability of free fatty acids and a possible glycogen sparing effect. Most of the differences in substrate metabolism after fat feeding were although only evident in the early stages of exercise and did not result in an improved performance. One also has to question the practicality and ethics of intravenous heparin together with fat intake.

Adaptation to High-fat, Low-carbohydrate Diets

Modification of an individual's habitual diet can significantly alter the subsequent patterns of substrate utilization during aerobic exercise and ultimately performance. A high fat intake over a period of one to three days markedly reduces muscle glycogen and increased fatty acid oxidation during sub maximal exercise. This shift in substrate utilization is although associated with impairment in exercise capacity. There is although some evidence to suggest that a longer period of adaptation to a high-fat diet may result in adaptive responses to increase the capacity for fatty acid oxidation. These adaptations suggest that sub maximal exercise capacity can be preserved in spite of low pre-exercise muscle glycogen content when trained individuals are adapted to a high-fat diet. Adherence to such a high fat diet for a prolonged period may be impractical and could also pose health problems. Short-term exposure to high-fat diets is also associated with insulin resistance resulting in a decreased hepatic glucose output and liver glycogen synthesis.

There may be extreme and unconventional events in which performance requires only a prolonged ability to work at low intensities. Athletes in these events might find it useful to experiment with fat adaptation strategies. However, for the typical range of activity which combines periods of high intensity with lower intensity activities, there seems no justification to recommend fat adaptation and glycogen restoration strategies. Athletes in these events would be attempting a protocol that is difficult and sometimes unpleasant to complete with the possibility of sabotaging their efforts.

References:
Burke, L. 2007. Practical Sports Nutrition. Human Kinetics.
Burke, L & Deakin, V. 2006. Clinical Sports Nutrition. McGraw Hill.
Williams, MH. 2007. Nutrition for Health, Fitness and Sport. McGraw Hill.
Burke, L, Kiens B & Ivy JL. 2004. Carbohydrate and Fat for Training and Recovery. J of Sports Sciences.