Recent studies have examined the metabolic and performance outcomes of a dietary periodisation strategy that aims to simultaneously optimise endogenous carbohydrate (CHO) stores while maximising the capacity for fat oxidation during prolonged submaximal exercise. Such "nutritional periodisation" typically encompasses 5-7 d of a high-fat diet followed by 1-2 d of high carbohydrate (CHO) intake (i.e. CHO restoration). Despite the brevity of the adaptation period, ingestion of a high-fat diet by endurance-trained athletes results in increases in the basal gene expression of the fatty acid (FA) translocase (FAT/CD36) and enzymes of FA metabolism, including \( \beta \)-hydroxyacyl-CoA. This results in substantially higher rates of fat oxidation and concomitant muscle glycogen "sparring" when subjects commence sub-maximal exercise with similar muscle glycogen content (i.e. 700-800 mmol/kg d.m.). Higher rates of fat oxidation during exercise persist despite conditions in which CHO availability is increased, either by having athletes consume a high-CHO meal prior to exercise and/or ingest glucose solutions during exercise. Surprisingly, despite metabolic perturbations that, in theory, should enhance endurance capacity, there are no clear benefits to the performance of prolonged exercise. Several theories are proposed to explain the lack of performance transfers. A possible reason for this "paradox" is a diet-induced reduction in the activity of pyruvate dehydrogenase (PDHa), which would act to impair rates of glycogenolysis at a time (i.e. during periods of exercise in which high intensity workrates are required) when muscle CHO requirements are high.