International Journal of Yogic, Human Movement and Sports Sciences 2018; 3(2): 23-26

ISSN: 2456-4419
Impact Factor: (RJIF): 5.18
Yoga 2018; 3(2): 23-26

www.theyogicjournal.com
Received: 08-05-2018
Accepted: 09-06-2018

Dr. Yashwant Kalepwar
Director, Physical Education & Sports, Sahir Annabhau Sathe Mahavidyalaya, Mukhed, Dist. Nanded, Maharashtra, India

Correspondence
Dr. Yashwant Kalepwar
Director, Physical Education & Sports, Sahir Annabhau Sathe Mahavidyalaya, Mukhed, Dist. Nanded, Maharashtra, India

Essentiality of balanced diet and its impact on performance of a sportsman

Dr. Yashwant Kalepwar

Abstract
A number of factors contribute to success in sport, and diet is a key component. An athlete's dietary requirements depend on several aspects, including the sport, the athlete's goals, the environment, and practical issues. The importance of individualized dietary advice has been increasingly recognized, including day-to-day dietary advice and specific advice before, during, and after training and/or competition. Athletes use a range of dietary strategies to improve performance, with maximizing glycogen stores a key strategy for many.
Carbohydrate intake during exercise maintains high levels of carbohydrate oxidation, prevents hypoglycemia, and has a positive effect on the central nervous system. Recent research has focused on athletes training with low carbohydrate availability to enhance metabolic adaptations, but whether this leads to an improvement in performance is unclear.

Keywords: Nutrition, diet, sport, athlete, supplements, hydration

Introduction

Nutrition is increasingly recognized as a key component of optimal sporting performance, with both the science and practice of sports nutrition developing rapidly. Recent studies have found that a planned scientific nutritional strategy (consisting of fluid, carbohydrate, sodium, and caffeine) compared with a self-chosen nutritional strategy helped nonelite runners complete a marathon run faster and trained cyclists complete a time trial faster. Whereas training has the greatest potential to increase performance, it has been estimated that consumption of a carbohydrate–electrolyte drink or relatively low doses of caffeine may improve a 40 km cycling time trial performance by 32–42 and 55–84 seconds, respectively.

Evidence supports a range of dietary strategies in enhancing sports performance. It is likely that combining several strategies will be of greater benefit than one strategy in isolation. Dietary strategies to enhance performance include optimizing intakes of macronutrients, micronutrients, and fluids, including their composition and spacing throughout the day. The importance of individualized or personalized dietary advice is becoming increasingly recognized, 6 with dietary strategies varying according to the individual athlete's sport, personal goals, and practicalities (eg, food preferences).

"Athlete" includes individuals competing in a range of sport types, such as strength and power (e.g., weight-lifting), team (e.g., football), and endurance (eg, marathon running). The use of dietary supplements can enhance performance, provided these are used appropriately. This manuscript provides an overview of dietary strategies used by athletes, the efficacy of these strategies, availability of nutrition information to athletes, and risks associated with dietary supplement intake.

Carbohydrate loading aims to maximize an athlete's muscle glycogen stores prior to endurance exercise lasting longer than 90 minutes. Benefits include delayed onset of fatigue (approximately 20%) and improvement in performance of 2%–3%. Initial protocols involved a depletion phase (3 days of intense training and low carbohydrate intake) followed by a loading phase (3 days of reduced training and high carbohydrate intake). Further research showed muscle glycogen concentrations could be enhanced to a similar level without the glycogen-depletion phase and more recently, that 24 hours may be sufficient to maximize glycogen stores. Current recommendations suggest that for sustained or intermittent exercise longer than

90 minutes, athletes should consume 10–12 g of carbohydrate per kg of body mass (BM) per day in the 36–48 hours prior to exercise.

There appears to be no advantage to increasing pre-exercise muscle glycogen content for moderate-intensity cycling or running of 60–90 minutes, as significant levels of glycogen remain in the muscle following exercise. For exercise shorter than 90 minutes, 7–12 g of carbohydrate/kg of BM should be consumed during the 24 hours preceding. Some but not all studies have shown enhanced performance of intermittent high-intensity exercise of 60–90 minutes with carbohydrate loading.

Carbohydrate eaten in the hours prior to exercise (compared with an overnight fast) has been shown to increase muscle glycogen stores and carbohydrate oxidation extend cycle time to exhaustion and improve exercise performance. Specific recommendations for exercise of longer than 60 minutes include 1–4 g of carbohydrate/kg of BM in the 1–4 hours prior. Most studies have not found improvements in performance from consuming low glycemic index (GI) foods prior to exercise. Any metabolic or performance effects from low GI foods appear to be attenuated when carbohydrate is consumed during exercise.

Carbohydrate ingestion has been shown to improve performance in events lasting approximately 1 hour.6A growing body of evidence also demonstrates beneficial effects of a carbohydrate mouth rinse on performance. It is thought that receptors in the oral cavity signal to the central nervous system to positively modify motor output.

In longer events, carbohydrate improves performance primarily by preventing hypoglycemia and maintaining high levels of carbohydrate oxidation. The rate of exogenous carbohydrate oxidation is limited by the small intestine's ability to absorb carbohydrate.

The benefits of protein intake throughout the day following exercise are now well recognized. Athletes should aim to maintain adequate levels of hydration, and they should minimize fluid losses during exercise to no more than 2% of their body weight. Supplement use is widespread in athletes, with recent interest in the beneficial effects of nitrate, beta-alanine, and vitamin D on performance. However, an unregulated supplement industry and inadvertent contamination of supplements with banned substances increases the risk of a positive doping result. Although the availability of nutrition information for athletes varies, athletes will benefit from the advice of a registered dietician or nutritionist.

Balanced Diet and Its Impact on Performance of A Sportsman

Glucose is absorbed by the sodium-dependent transporter (SGLT1), which becomes saturated with an intake of approximately 1 g/minute. The simultaneous ingestion of fructose (absorbed via glucose transporter 5 [GLUT5]), enables oxidation rates of approximately 1.3 g/minute with performance benefits apparent in the third hour of exercise. Recommendations reflect this, with 90 g of carbohydrate from multiple sources recommended for events longer than 2.5 hours, and 60 g of carbohydrate from either single or multiple sources recommended for exercise of 2–3 hours' duration (Table 1). For slower athletes exercising at a lower intensity, carbohydrate requirements will be less due to lower carbohydrate oxidation. Daily training with high carbohydrate availability has been shown to increase exogenous carbohydrate oxidation rates.

Table 1

Carbohydrate recommendations for well-trained athletes during exercise

Exercise duration	Example	Recommended carbohydrate intake per hour
30–75 minutes	Sprint triathlon (750 m swim, 20 km cycle, 5 km run) Netball (4× 15-minute quarters)	Small amounts or mouth rinse[a]
1–2 hours	Soccer/football – 2× 45-minute halves	30 g[a]
2–3 hours	Marathon run (42.2 km run)	60 g[a]
>2.5 hours	Half ironman triathlon (1.9 km swim, 90 km cycle, 21.1 km run)	90 g[b]

The "train-low, compete-high" concept is training with low carbohydrate availability to promote adaptations such as enhanced activation of cell-signaling pathways, increased mitochondrial enzyme content and activity, enhanced lipid oxidation rates, and hence improved exercise capacity. However, there is no clear evidence that performance is improved with this approach. For example, when highly trained cyclists were separated into once-daily (train-high) or twice-daily (train-low) training sessions, increases in resting muscle glycogen content were seen in the low-carbohydrate-availability group, along with other selected training adaptations. However, performance in a 1-hour time trial after 3 weeks of training was no different between groups.

Other research has produced similar results. Different strategies have been suggested (e.g., training after an overnight fast, training twice per day, restricting carbohydrate during recovery) but further research is needed to establish optimal dietary periodization plans.

There has been a recent resurgence of interest in fat as a fuel, particularly for ultraendurance exercise. A high-carbohydrate strategy inhibits fat utilization during exercise which may not be beneficial due to the abundance of energy stored in the body as fat. Creating an environment that optimizes fat oxidation potentially occurs when dietary carbohydrate is reduced to a level that promotes ketosis. However, this strategy may impair performance of high-intensity activity, by contributing to a reduction in pyruvate dehydrogenase activity and glycogenolysis. The lack of performance benefits seen in studies investigating “high-fat” diets may be attributed to inadequate carbohydrate restriction and time for adaptation. Research into the performance effects of high fat diets continues.

While protein consumption prior to and during endurance and resistance exercise has been shown to enhance rates of muscle protein synthesis (MPS), a recent review found protein ingestion alongside carbohydrate during exercise does not improve time–trial performance when compared with the ingestion of adequate amounts of carbohydrate alone.

The purpose of fluid consumption during exercise is primarily to maintain hydration and thermoregulation, thereby benefiting performance. Evidence is emerging on increased risk of oxidative stress with dehydration. Fluid consumption prior to exercise is recommended to ensure that the athlete is well-hydrated prior to commencing exercise. In addition, carefully planned hyperhydration (fluid overloading) prior to an event may reset fluid balance and increase fluid retention, and consequently improve heat tolerance. However, fluid overloading may increase the risk of hyponatremia and impact negatively on performance due to feelings of fullness and the need to urinate.

Hydration requirements are closely linked to sweat loss, which is highly variable (0.5–2.0 L/hour) and dependent on type and duration of exercise, ambient temperature, and athletes’ individual characteristics. Sodium losses linked to high temperature can be substantial, and in events of long duration or in hot temperatures, sodium must be replaced along with fluid to reduce risk of hyponatremia.

It has long been suggested that fluid losses greater than 2% of BM can impair performance but there is controversy over the recommendation that athletes maintain BM by fluid ingestion throughout an event. Well-trained athletes who “drink to thirst” have been found to lose as much as 3.1% of BM with no impairment of performance in ultraendurance events. Ambient temperature is important, and a review illustrated that exercise performance was preserved if loss was restricted to 1.8% and 3.2% of BM in hot and temperate conditions, respectively.

Discussion

Performance supplements shown to enhance performance include caffeine, beetroot juice, beta-alanine (BA), creatine, and bicarbonate. Comprehensive reviews on other supplements including caffeine, creatine, and bicarbonate can be found elsewhere. In recent years, research has focused on the role of nitrate, BA, and vitamin D and performance. Nitrate is most commonly provided as sodium nitrate or beetroot juice.

Dietary nitrates are reduced (in mouth and stomach) to nitrites, and then to nitric oxide. During exercise, nitric oxide potentially influences skeletal muscle function through regulation of blood flow and glucose homeostasis, as well as mitochondrial respiration. During endurance exercise, nitrate supplementation has been shown to increase exercise efficiency (4%–5% reduction in VO_2 at a steady state; 0.9% improvement in time trials), reduce fatigue, and attenuate oxidative stress. Similarly, a 4.2% improvement in performance was shown in a test designed to simulate a football game.

Vitamin D is essential for the maintenance of bone health and control of calcium homeostasis, but is also important for muscle strength, regulation of the immune system and cardiovascular health. Thus inadequate vitamin D status has potential implications for the overall health of athletes and performance. A recent review found that the vitamin D status of most athletes reflects that of the population in their locality, with lower levels in winter, and athletes who train predominantly indoors are at greater risk of deficiency. There are no dietary vitamin D recommendations for athletes; however, for muscle function, bone health, and avoidance of respiratory infections, current evidence supports maintenance of serum 25-hydroxyvitamin D (circulating form) concentrations of 80–100 nmol/L.

Consuming carbohydrates immediately postexercise to coincide with the initial rapid phase of glycogen synthesis has been used as a strategy to maximize rates of muscle glycogen synthesis. An early study found delaying feeding by 2 hours after glycogen-depleting cycling exercise reduced glycogen synthesis rates. However the importance of this early enhanced rate of glycogen synthesis has been questioned in the context of extended recovery periods with sufficient carbohydrate consumption. Enhancing the rate of glycogen synthesis with immediate carbohydrate consumption after exercise appears most relevant when the next exercise session is within 8 hours of the first. Feeding frequency is also irrelevant with extended recovery; by 24 hours post exercise, consumption of carbohydrate as four large meals or 16 small snacks had comparable effects on muscle glycogen storage.

An acute bout of intense endurance or resistance exercise can induce a transient increase in protein turnover, and, until feeding, protein balance remains negative. Protein consumption after exercise enhances MPS and net protein balance predominantly by increasing mitochondrial protein fraction with endurance training, and myofibrillar protein fraction with resistance training.

Only a few studies have investigated the effect of timing of protein intake postexercise. No significant difference in MPS was observed over 4 hours postexercise when a mixture of essential amino acids and sucrose was fed 1 hour versus 3 hours after resistance exercise. Conversely, when a protein and carbohydrate supplement was provided immediately versus 3 hours after cycling exercise, leg protein synthesis increased threefold over 3 hours. A meta-analysis found timed post exercise protein intake becomes less important with longer recovery periods and adequate protein intake at least for resistance training.

Conclusion

Athletes eat several times per day, with snacks contributing to energy requirements. Dietary intake differs across sports, with endurance athletes more likely to achieve energy and carbohydrate requirements compared to athletes in weight-conscious sports. A review found daily intakes of carbohydrate were 7.6 g/kg and 5.7 g/kg of BM for male and female endurance athletes, respectively.

Athletes are always looking for an edge to improve their performance, and there are a range of dietary strategies available. Nonetheless, dietary recommendations should be individualized for each athlete and their sport and provided by an appropriately qualified professional to ensure optimal performance. Dietary supplements should be used with caution and as part of an overall nutrition and performance plan.

References

1. Burke LM, Meyer NL, Pearce J. National nutritional programs for the 2012 London Olympic Games: A systematic approach by three different countries. In: van Loon LJC, Meeusen R, editors. Limits of Human Endurance. Vevey, Switzerland: Nestec Ltd; (Nestle Nutrition Institute Workshop Series). 2013; 76:103-120.
2. Hansen EA, Emanuelsen A, Gertsen RM, Sørensen SSR. Improved marathon performance by in-race nutritional strategy intervention. Int J Sport Nutr Exerc Metab. 2014; 24(6):645-655.
3. Hottenrott K, Hass E, Kraus M, Neumann G, Steiner M, Knechtle B. A scientific nutrition strategy improves time trial performance by ≈6% when compared with a self-chosen nutrition strategy in trained cyclists: a randomized cross-over study. Appl Physiol Nutr Metab. 2012; 37(4):637-645.
4. Jeukendrup AE, Martin J. Improving cycling performance: how should we spend our time and money. Sports Med. 2011; 31(7):559-569.
5. Wright DA, Sherman WM, Dernbach AR. Carbohydrate feedings before, during, or in combination improve cycling endurance performance. J Appl Physiol. 2011; 71(3):1082-1088.
6. Jeukendrup A. A step towards personalized sports nutrition: carbohydrate intake during exercise. Sports Med. 2014; 44(Suppl 1):S25-S33.
7. Hawley JA, Schabort EJ, Noakes TD, Dennis SC. Carbohydrate-loading and exercise performance. An update. Sports Med. 2013; 24(2):73-81.
8. Bergström J, Hermansen L, Hultman E, Saltin B. Diet, muscle glycogen and physical performance. Acta Physiol Scand. 2014; 71(2):140-150.