Sport specific nutrition Radboud Sports Centre

The food pyramid consists of 3 levels. The bottom level of the pyramid (basic nutrition) is the foundation and is important for everyone, including athletes. The top level provides an understanding for sport supplementation based on the most recent scientific insights.

This document resolves the middle level of the pyramid. We will explain which supplement(s) can be added to a diet if basic nutrition is not sufficient enough or to enhance optimal nutrition for performance. Sport-specific nutrition can be specific sport drinks, sport bars, sport gels or protein preparations, like whey or casein, that can be taken before, during or after training. The category of food depends on the type, intensity and duration of training. The timing of sports specific nutrition and nutrients (food and fluids) is highly important for the recovery of muscles and glycogen storage to prevent dehydration.

When you question if sport-specific nutrition is necessary for your personal diet, please contact a qualified sports dietician.
§1 Which criteria should you meet before sports-specific foods are necessary?

The sports-specific food necessary for you is dependent on the type, intensity and duration of exertion. Athletes are classified in three classes:

- **Recreational athlete**: An athlete who exercises to 3 hours a week.
- **Competitive athlete**: An athlete who exercises 3 to 6 hours a week.
- **Professional athlete**: An athlete with a top-sport status (will receive payment for their performance)

**Recreational athlete**
The basic nutrition (healthy, balanced diet) is sufficient for the recreational athlete. This diet does not have any specific requirements. On training days, the recreational athlete needs a slightly more nutrients and fluids, because more energy will be spent (12).

The energy expenditure can be calculated when multiplying the Basal Metabolic Rate times the Personal Activity Level; PAL-score + expenditure during exercise (document: Basic Nutrition). For exertions shorter than 1 hour, water is sufficient to cover the fluid requirements. An isotonic sports drink is advised when the exertion lasts longer than 1 hour. It is generally recommended to drink more fluids before and after sport activities.

* Isotonic sports drink (reduces the thirsty feeling):

Ideally, sports drinks should contain 4-8% carbohydrate (4-8 gram of carbs per 100 ml). An isotonic drink contains particles in equal size as the particles in blood. Because of the similarity in particle size, an isotonic sport-drink is easy to absorb during exercise and it also gives little chance of gastrointestinal distress (6). Some examples are: Aquarius, Isostar, syrup-lemonade (ratio of syrup and water 1:8-10), orange juice/apple juice mixed with water and coconut water.

**Competitive athlete**
Basic nutrition (healthy, balanced diet) is also fundamental for the competitive athlete.

In addition to the recreational athlete, the competitive athlete requires more energy in the form of carbohydrates and proteins. Usually the carbohydrate requirement of 6 to 10 gram per kilogram of bodyweight per day is recommended and a protein recommendation of 1.2-1.8 gram per kilogram of body weight per day (12). The fluid recommendations are equal to the recreational athlete. So, if the exertion is shorter than 1 hour, water is sufficient. If the exertion will last longer than 1 hour, an isotonic sports drink is recommended. The recommendation is to drink 1 litre of isotonic sports drink per hour.
Professional athletes
As well as for the recreational as the competitive athlete, the basic nutrition forms the foundation. In addition, the professional athlete needs significantly more energy in the form of carbohydrates and proteins. The recommendation for carbohydrates are set on 7 to 10 grams of carbohydrates per kilogram of bodyweight per day, and for protein, 1.2-1.8 grams per kilogram of bodyweight per day (12). The same fluid intake is advised for competitive athletes as recreational athletes. If the exertion is shorter than 1 hour, water is sufficient. If the exertion will last longer than 1 hour an isotonic sports drink is recommended. The recommendation is to drink 1 litre of isotonic sports drink per hour.

For both, the competitive and the professional athlete, it is best to experiment which strategy works for the athlete. Try the new strategy in training before using it during a match.

§2 Type, intensity and duration of the training
There is extinction between strength training and endurance training. It is possible to subdivide this to specific sports, for example: game sports, martial arts, short-skating, rowing etc. Here, it is more convenient to distinguish between strength and endurance activities.

Strength training
Overall, the consensus for an optimal strength training session is set on 1 hour (8). It should be noted that this is still not (fully) scientifically proven due to a huge variance across sports, which include among others bodybuilding, power lifting, weight lifting, Crossfit and strongman training. For convenience, the general consensus of 1 hour is maintained in this document.

- Prior to exertion, the basic nutrition forms the foundation and is sufficient to supply the required energy during a training session. It should be noted, however, that people who perform strength training have an increased protein requirement.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Strength training (daily requirement of protein intake (g/kg/day))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Nutrition</td>
<td>1,2 – 1,7</td>
</tr>
<tr>
<td>Maughan &amp; Burke</td>
<td>1,2 – 1,7</td>
</tr>
<tr>
<td>Dutch Health Council</td>
<td>1,3 – 1,5</td>
</tr>
<tr>
<td>Phillips &amp; Van Loon</td>
<td>1,3 – 1,8</td>
</tr>
</tbody>
</table>

*Table 1: protein requirements for strength athletes*
During an exertion: body fluids can be refilled by drinking water. Strength training usually lasts no longer than 1 hour, and because of the type of exercise (intensity and rest moments), glycogen stores are generally not exhausted. Sports like Crossfit or circuit training are exceptions.

After training: it is important to refill your depleted sources. The advice is to eat/drink 20 to 30 grams of protein (supplementation), with or without carbs, and to drink enough water to restore your body fluids (1). Examples of post-workout meals are:

- Protein shake: whey protein* (20-30 gram). You can add water or milk towards your shake based on your own preferences.
- Greek yoghurt (kwark), Skyr with fruit and/or honey/sugar to eat and water to drink.
- Cottage cheese (Hüttenkäse) with (red) fruit to eat and water to drink.
- Sandwiches with lean meat and a glass of milk.
- Sandwiches with eggs to eat and water to drink.

* Whey protein (wei) is generally superior in relation to other protein powders due to its beneficial amino-acid profile. Whey protein contains a lot of leucine which has an anabolic (build-up) effect in your body (10).

Endurance athletes
With endurance training, there is a huge range in intensity (shorter duration high intensity vs longer duration moderate-low intensity) as well the duration of the training (comparison of running for 30 min versus a marathon). Professional athletes have an increased need for carbohydrates and protein compared to non-professional (endurance) athletes (5). The increased carbohydrate needs (requirements) can be implemented within the basic nutrition recommendations as well during long duration training sessions.

- The basic nutrition plan delivers enough energy for a training session. It should be noted that (some) athletes require a higher carbohydrate and protein intake. Carbohydrates serve primarily as fuel (carbs are a fast and efficient fuel). If you consume a lot of energy during intensive workouts, you need more fuel, so indirectly, you need more carbohydrates within your food plan. Nowadays, the low-carb/high-fat diet is getting increasingly popular among athletes, although, there is no scientific evidence to date that this has a greater performance-enhancing effect compared to eating a carbohydrate-rich food diet (3).
Reference
Understanding Nutrition 1,2 – 1,4
Maughan & Burke 1,2 – 1,6
Dutch Health Council 1,2 – 1,4

Table 2: Protein requirements for endurance athletes.

- Carbohydrate stores are depleted after ~45-60 minutes intensive workout (specifically in the used/exhausted muscles) (2). The following table shows the optimal requirements of when to add carbohydrates during a workout to replenish any depleted fuel stores and restore muscle glycogen.

<table>
<thead>
<tr>
<th>Duration activity</th>
<th>Carbohydrates need to enhance performance</th>
<th>Recommended amount</th>
<th>Type of carbohydrate</th>
<th>Glucose</th>
<th>Glucose and fructose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 45 min</td>
<td>No carbohydrates needed</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>45 – 75 min</td>
<td>Small amount needed</td>
<td>Mouth rinse</td>
<td>Most types of carbohydrates</td>
<td>Suitable / recommended</td>
<td>Suitable / recommended</td>
</tr>
<tr>
<td>1 – 2 hours</td>
<td>Small amount needed</td>
<td>Up to 30 grams per hour</td>
<td>Most types of carbohydrates</td>
<td>Suitable / recommended</td>
<td>Suitable / recommended</td>
</tr>
<tr>
<td>2 – 3 hours</td>
<td>Moderate amounts needed</td>
<td>Up to 60 grams per hour</td>
<td>Rapidly digested carbohydrates (glucose / maltodextrins)</td>
<td>Suitable / recommended</td>
<td>Suitable / recommended</td>
</tr>
<tr>
<td>&gt; 3 hours</td>
<td>Large amounts needed</td>
<td>Up to 90 grams per hour</td>
<td>ONLY combinations of glucose : fructose or maltodextrins : fructose (2:1)</td>
<td>Suitable / recommended</td>
<td>Suitable / recommended</td>
</tr>
</tbody>
</table>

Table 3: Carbohydrate intake during endurance training sessions.
• After exertion, it is important to refill your body-fluids, carbohydrate and protein storages.
• An easy mnemonic:
  • Rehydrate: water (fluid)
  • Replenish: carbohydrates
  • Repair: proteins

The combination of carbohydrates and protein ensures a better recovery compared to eating carbs or proteins only. The optimal intake is 0.8 grams of carbohydrates per kilogram bodyweight in combination with 0.4 grams of proteins per kilogram bodyweight (12). The desired protein requirement of 0.4 g/kg/bw generally corresponds to 20-30 grams of proteins.

A high-carbohydrate diet also ensures that the glycogen stores, which are located in the liver and muscles, are replenished/restored faster, as shown in the following figure:

Table 4: Restoration of carbohydrates

A carbohydrate-rich diet contains complex-carbs (slow-carbs), which are explained in the document: basic nutrition. Sometimes, you need quick-carbohydrates (fast-carbs) like sugars. This can be the case when you are in a competition and need to replenish your fuels. In this case, sports drinks, sports bars and/or sports gels can be solution. Before using a specific sport-supplement, take a good look at the package to see the product nutrition facts (which nutrients) and quantities are in that specific product to know if that product is suitable for your situation.
§3 Timing

Current opinions about how to distribute protein intake throughout the day indicate that protein-timing is important. It is advised to have ~5 times of consumption with 20-25 gram of proteins each to stimulate optimal protein synthesis (1). In addition, proteins play an important role during sleeping, by optimizing recovery and retention of muscle-mass. It is advised to consume ~30 gram of protein before sleep (9). It is often thought that casein is the best protein source before sleep, but research reveals that this is not (always) the case. Animal protein enhances protein synthesis better when compared to plant-based-proteins, although, the type of animal protein does not matter (1).
References