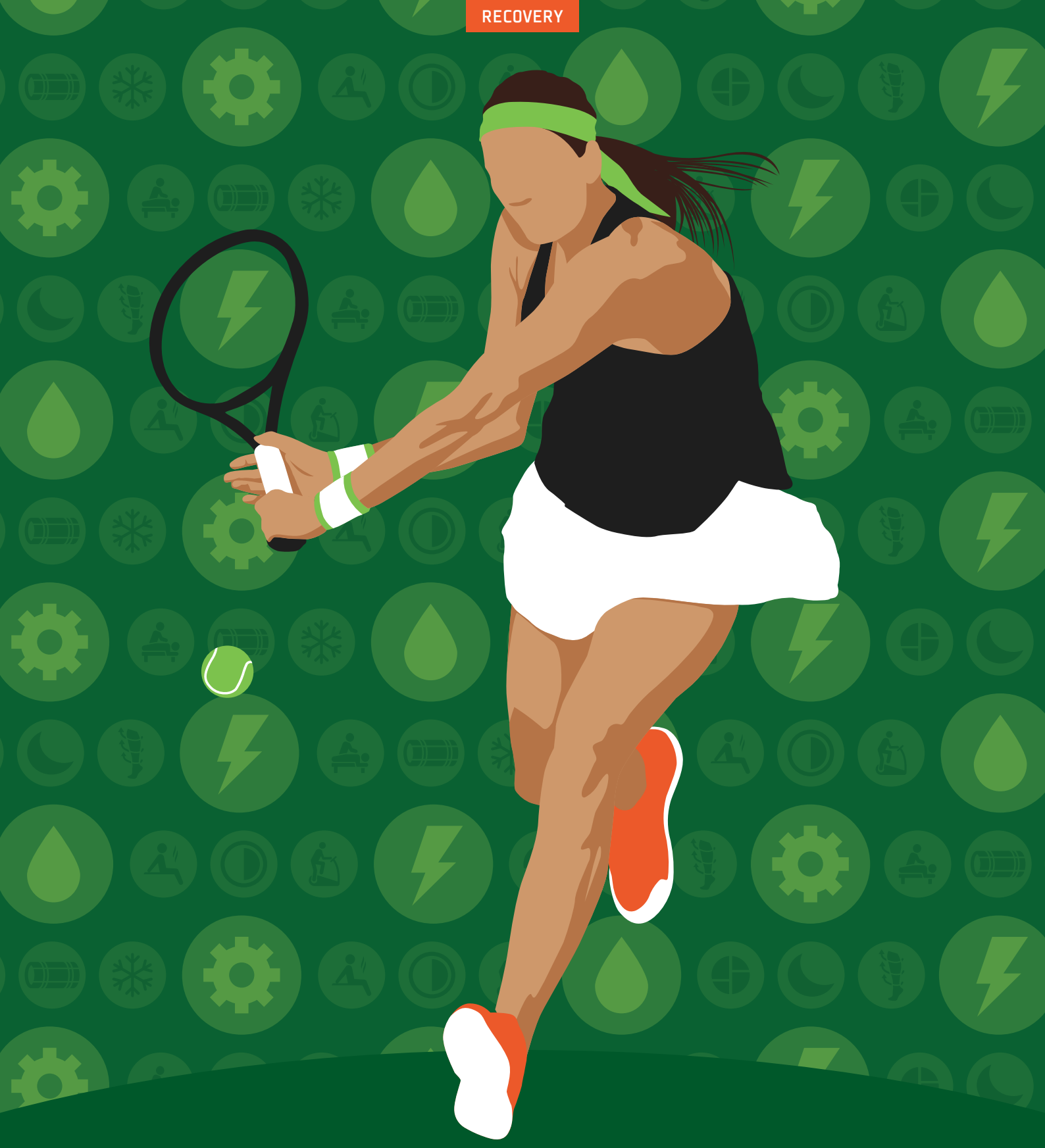

Recovery

for Female Athletes

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Introduction

The use of recovery strategies after exercise helps athletes to be ready to perform again during their next bout of exercise. From a nutrition perspective, there are three important recovery factors that should be focused on: refueling energy (glycogen) stores, repairing muscles, and rehydrating the body. These nutrition strategies will complement and maximize the benefits from other recovery modalities such as foam rolling, ice baths, sleep, compression, garments, and massage (it should however be noted that the scientific evidence for each modality varies).

Consistency in recovery after exercise will be beneficial to an athlete's overall health and performance. The information below will explain key nutrition considerations to optimize and speed up recovery after exercise, which is especially important during periods of intense training and competition. It is important to note that there are currently no female-specific guidelines for recovery from exercise. Athletes should be worked with on an individual basis to guide them on how they can optimally meet their recovery needs.

The three key recovery priorities to optimize recovery from a nutrition perspective are: (1) Refuel, (2) Repair and (3) Rehydrate. These can be remembered as the '3 R's'. Each are explained in detail below.

Refuel | **Repair** | **Rehydrate**

Refuel ▸ Carbohydrate

During exercise, especially that of high intensity, the body uses glycogen (carbohydrate) stores for energy. Glycogen stores will decline during exercise and therefore they need to be replenished afterwards. This can be achieved by eating carbohydrate-rich foods and beverages. This will 'refill' glycogen stores for when the next bout of exercise begins. It can take up to ~24 hours to fully replenish glycogen stores after exercise, depending on the intensity and duration of the exercise. Higher-intensity and/or longer duration exercise will reduce glycogen stores to a greater extent.

In order to optimize glycogen restoration post-exercise, athletes should ideally consume a snack containing carbohydrate after finishing exercise, within ~30 minutes (Figure 1). Following this, they should aim to eat a meal which contains carbohydrate, within ~2 hours (Figure 3).

If the exercise completed is likely to have depleted glycogen stores, then a more intense strategy is recommended: 1.2 grams of carbohydrate per kg of body mass, per hour, for 4-6 hours. This recommendation is however based on low sample size studies carried out in male athletes.

Some female athletes may find it challenging to consume this amount. If carbohydrate intake is sub-optimal, adding protein to post-exercise drinks or meals can help improve glycogen recovery.

Some situations may require an increase in daily carbohydrate intake following initial refueling. For example:

- **During multi-day sporting events**
- **During a busy period of competition**
- **When undertaking high-intensity and/or long duration exercise, with multiple exercise sessions during a 24-hour period**

Post-exercise high carbohydrate snack ideas


Banana


Bread/toast


Sports drink


Granola bar/flapjack


Cereal/granola


Rice cakes

Figure 1

Repair ▸ Protein

Following exercise, muscles need to repair and remodel, which helps the body to adapt to the demands of exercise. To maximize muscle repair and adaptation after exercise (also known as muscle protein synthesis), athletes should aim to consume 20-40 grams of protein at regular intervals i.e., every 3-4 hours.

Following exercise, this can be done by:

- Having a high protein snack (alongside a high carbohydrate snack) soon afterwards
- Having a meal high in protein (and carbohydrate) ~2 hours afterwards (see Figure 3 for examples)
- Ensuring high quality protein sources are incorporated into meals and snacks for ~24 hours afterwards

Athletes may wish to use protein powder during recovery from exercise. As a guide, athletes should aim to use protein powders that contain whey, soy or casein protein, because they are considered a 'complete' source of protein. In addition, protein blends containing a range of plant-based proteins to achieve a full complement of EAA can also be advised.

Examples of 20-40g of protein


¾ cup of Greek yogurt


3.5 oz of chicken breast


3.5 oz of salmon


3–4 eggs


1 tin of fish


5 oz of tofu


20 oz of cow's or soy milk


½ cup of soybeans


1 scoop of protein powder

Figure 2

Example recovery meals


Pasta with sauce

Carbohydrate: Pasta

Protein: Meat in the sauce e.g., beef or chicken


Rice/noodle based stir fry

Carbohydrate: Rice/noodles

Protein: Meat, tofu, fish or beans in the stir fry


Baked potatoes with filling

Carbohydrate: Potato

Protein: Filling e.g., tuna, beans, chicken


Sandwiches with filling

Carbohydrate: Bread

Protein: Filling e.g., lean meat, egg, tuna, hummus

Figure 3

Consuming protein prior to sleeping is beneficial for overnight recovery. Some pre-sleep high protein snack ideas include:


Hot cocoa (made with milk and/or chocolate protein powder)


Bowl of Greek yogurt


Cottage cheese on crackers


Protein shake

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Rehydrate ▸ Fluids

Rehydration is an important part of the recovery process in order to replace fluid lost during exercise. The aim is to completely replace fluid and electrolyte losses prior to the start of the next bout of exercise. Athletes can obtain personalized post-exercise fluid requirements by using the Gx patch, or by using the guidelines set out in 'Hydration'. In brief, athletes should begin to rehydrate immediately after exercise by sipping on fluids such as water, a sports drink or a protein shake. Following this, athletes should continue to sip on fluids to continue to rehydrate.

In most situations, normal eating and drinking practices will replace water and sodium that has been lost. However, if dehydration is severe (>5% of body mass) or if rapid rehydration is needed (<24 hours before next exercise bout), it is recommended for athletes to drink 1.5 L of fluid for each 1 kg of body mass lost.

Practical suggestions

Beverages often provide a convenient option as athletes can sip on them at their own pace if they do not have appetite for food. Suggested items to meet all recovery requirements after exercise are protein shakes or smoothies (both ideally made with milk, see Figure 4). These are both good options because they contain the fluid, protein and carbohydrate to kick start an athlete's recovery all in one go. Dairy and soy milks (including flavoured milks) are also good options to include within a post-exercise recovery beverage for the same reason. If athletes have the resources, they can prepare a smoothie before exercise, or buy a ready to drink beverage, to take with them to ingest straight after exercise. In addition, sports drinks are a good option post-exercise because they contain fluid and electrolytes, as well as carbohydrate, which help athletes to begin rehydrating and refueling.

Recovery smoothies

Mix and match the ingredients below to create a smoothie which contains carbohydrate, protein and fluid - the perfect post-exercise recovery snack!

Protein

- Protein powder
- Milk powder
- Yogurt

Carbohydrate

- Fruits: Banana, apple, mango, pineapple, orange, strawberry, cherries, blueberries
- Honey
- Frozen fruit
- Dried fruits

Fluid base

- Water
- Fruit juices (adds carbohydrate)
- Cow's milk (adds protein)
- Soy milk (adds protein)
- Almond milk
- Oat milk

Figure 4

Considerations

It is important to recognize that it is natural for athletes not to feel hungry after exercise. It is however a barrier to meeting nutrition recommendations to support recovery. If this is an issue, there are strategies that can be used to ensure athletes still recover. After athletes have finished exercise, they can wait 20-30 minutes for the blood to be redistributed from exercising muscles to the gut before starting their recovery food or beverage. They can then begin to sip on fluids, rather than being in a hurry to begin eating solid foods.

The guidelines outlined above are to “optimize” and “speed up” recovery. The need to recover quickly depends on when the athlete is next required to perform. In many circumstances there is plenty of time to refuel, repair and rehydrate in the days prior to the next intense bout of exercise, allowing athletes time to be ready to perform at their best again.

Competition recovery timeline

	Potential general recovery strategies	Nutrition recovery strategies
COMPETITION DAY	**Compression garments** **Sleep**	**Within 30 min afterwards** A snack high in carbohydrate and protein **Within ~2 hours afterwards** A meal high in carbohydrate and protein **Rehydrate post-competition with fluids** Milk based drinks, a protein shake or a sports drink are good options
+1 COMPETITION DAY	**Foam rolling and stretching** **Massage/physio treatment** **Active/gym recovery** **Bath/jacuzzi/sauna/contrast therapy**	**Ensure meals contain sufficient and high quality carbohydrate and protein sources** **Continue to rehydrate with fluids and monitor hydration status**

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RECOVERY

Refuel

- Carbohydrate snack within 30 mins
- Carbohydrate-rich meal within 2 hours
- Adjust daily carbohydrate intake according to duration and intensity of exercise completed
- If carbohydrate intake is sub-optimal, adding protein to meals/ snacks can help improve glycogen recovery

Repair

- Protein source (20-30g) after exercise
- Ensure high protein foods are included in meals for 24 hours afterwards
- Pre-sleep protein

Rehydrate

- Sip on fluids
- Ideally consume 125-150% of body mass losses
- Combine fluids with meals / food

Post Exercise

Shake, milk or smoothie

Competition Day

Competition Day + 1

Supported by additional strategies

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