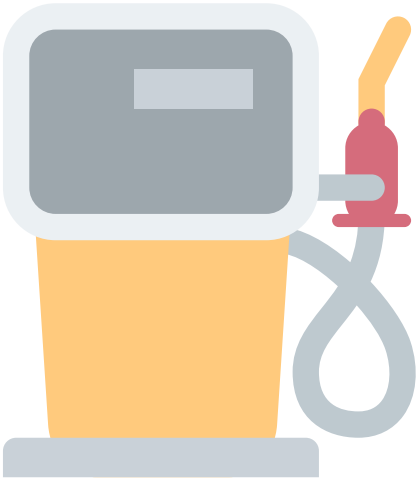
# FUELING 101

## *Pre-Workout Nutrition*



As an athlete, you know all too well... You won't be able to compete at your best unless you train consistently at your best. Likewise, proper fueling and nourishment through well-planned, reliable access to nutritious food is key to optimizing your performance throughout the training season and for your big events.

## Consider this...

Would you expect your car to take you from point A to B without timely oil change/maintenance, using incorrect fuel and waiting *every single time* for the gas light to come on before considering where the closest gas station is?

Improperly fueling for exercise is comparable to the above scenario. The benefits of properly fueling, hydration and preparing your body for the type of fuel to be used (for training, recreational activity and competitions) are listed below:

1. Reduced risk of hypoglycemia (low blood sugar)
Think: light-headedness, sluggishness, blurred vision

2. Helps your stomach settle (with trial. error and consistency) through absorbing gastric juices and warding off symptoms of hunger early on during activity

3. Fuels your muscles with carbs in the form of **glycogen** and brain in the form of **glucose** (sugar) from meals consumed the day prior, and/or within 3 hours-30 minutes of activity

4. Fuels your body to exercise harder so you are able to use up more energy and achieve desired results

5. Provides peace of mind knowing you are well-fueled for your activity

## Nutrient Timing

For training sessions later in the day, it is optimal to enjoy your pre-workout meal 2-3 hours before exercise. As the meal/snack window approaches your workout (or the earlier your workout/training session), the recommended meal composition becomes smaller and simpler. The closer you eat to your activity, the easier-to-digest your meal should be. This generally looks like a source of carbohydrate and some protein. Fat takes much longer to digest which can disrupt your energy and lead to digestive distress while engaging in activity.

# Introducing Your Teammates

## Carbohydrate

- Starch (complex carbohydrate) breaks down into glucose (simple sugar) which is used as fuel for muscles
- The storage form of carbohydrate in liver and muscles is glycogen
- With strategic fueling, you can utilize glycogen effectively throughout endurance activity (slow burn)

## Protein

- Protein breaks down into amino acids which are building blocks for protein structures/muscle in our bodies
- Eating protein before exercise:

1. Stimulates muscle growth
2. Improves muscle recovery
3. Improves strength
4. Enhances performance

## Fat

- Since glycogen only lasts ~90 minutes, our bodies are able to draw from fat stores for energy when activity is longer and of low/moderate intensity
- If a source of dietary fat (meat, nuts/butters, oils, high fat dairy) is consumed before activity, it should be 2-3 hours prior to allow time for digestion

# **If You Eat:** 2-3 hours (+) before

This is considered an optimal window for eating, since you can eat a complete meal to supply your muscles with energy, macro and micro-nutrients.
**Carbs:** In the form of starchy veggies/grains for a slow energy burn to keep you satisfied until your activity. High fibre foods (dried fruit, raw veg) may lead to discomfort depending on the type of activity. Tweak as needed!
**Protein:** Supplies a steady stream of amino acids for protein synthesis and blood sugar support
**Fat:** Slows the digestion of food to make nutrients available closer to activity. Assists in fat-soluble nutrient absorption.
**Examples:** Egg/salmon/tuna sandwich on whole grain bread with quinoa/bean/lettuce salad // Loaded oats with berries, banana, nut butter & greek yogurt // Eggs + toast + fruit // "Balanced plate template": Protein + starch/grain + colour
**Pro Tip:** This time frame includes the evening prior to activity the next morning (i.e. dinner before a morning training session or competition). Work with your dietitian to review the "**performance plate**" proportions suitable to your activity!

# **If You Eat:** 1 hour before

Choose a lighter meal/snack than above, which will provide fuel without weighing you down or being too filling.
**Carbs:** Lower fibre fruit (banana, grapes, starchy veg), crackers, bread, cereals will digest quicker for available energy
**Protein:** Include a source of amino acids to be available for muscle repair during activity (lean/non-fatty protein)
**Fat:** Keep it low (i.e. under 5g total) to avoid feeling sluggish due to slowed digestion of your meal/snack
**Examples:** Protein bar + Greek yogurt + banana // Quick oats + whey protein (proats) + fruit // Smoothie with fruit + milk

# **If You Eat:** Within 30 minutes of activity

This may be your pre-workout timeline if you work out first thing! Eating something is better than nothing at all.
**Carbs:** Keep it simple (not starchy or fibrous) i.e. rice, banana, rice cakes, baby cereal/puree pouches or gels
**Protein:** Supplemental sources of protein (whey versus casein protein) digest quicker than whole food protein
**Fat:** Avoid this close to activity to allow quick digestion, absorption and energy availability during exercise
**Examples:** Protein shake (whey protein) + fruit // Greek yogurt + honey // Nutrition bar (ask your dietitian for ideas!) // Proats or quick oats + low fat yogurt

**References:**

- Nancy Clark's Sports Nutrition Guidebook- 5th Ed
- Advanced Sport Nutrition- Dan Benardot RD
- Healthline: Pre-Workout Nutrition- What to Eat Before a Workout
- Merotto, L. Pre-workout Nutrition: Macros & Meal Timing (leighmerotto.com)

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## FUELING DURING AND AFTER EXERCISE

### Fueling During Exercise

Just as what you eat **before** exercise plays a crucial role in how you perform during training and events, so does your fueling strategy **during** and **after** your activity. In particular, fueling up during exercise is critical when the moderate-intense activity lasts longer than one hour. The roles of intra-activity nutrition include:

1. Maintaining hydration
2. Providing your body with immediate fuel
    - ✓ *For instance, fueling with a high fat food can slow down digestion, affecting the availability of energy, making you feel sluggish and leading to digestive woes*
3. Boosting performance
4. Preserving muscle mass
5. Improving recovery

Table 1 provides an overview of the quantity of carbohydrate to aim for during exercise. Use this as your compass when perusing the charts that follow, which provide lists of carbohydrate-containing foods, and creating your training and game-day fueling plan (fueling plan template is available within Table 3).

Table 1. Exercise duration and suggested fueling

| Exercise Duration/Type | Carbohydrate Intake During Activity |
|---|---|
| < 45 minutes<br>**Example:** Workout at the gym | No fuel required during the workout, other than a pre-exercise snack.<br>**Example:** See "Fueling 101: Fueling Before Exercise" handout<br>Water can be consumed throughout the activity |
| 1 - 2 ½ hours moderate-intense activity<br>**Examples:** Soccer game, half-marathon, swim practice/meet | **Fuel:** 30-60g of carbohydrate/hour after the first hour of activity. If you filled up your tank prior to your activity using the handout listed above, you do not need to consume fuel within the first hour of activity.<br>**Examples:** Banana, dried fruit (i.e. dried pineapple, apple, pretzels) // Food items that contain "high glycemic index" carbohydrate choices (speak with your dietitian about timing high versus low glycemic index fuel choices) |
| > 2 ½ hours low-moderate activity<br>**Examples:** Walking a marathon, all-day bike ride, hiking | **Fuel:** At least 30g of carbohydrate/hour, or according to appetite<br>**Examples:** Banana bread, trail mix, dried fruit, hummus wrap, other foods that settle well |
| > 2 ½ hours moderate-high intensity/non-stop activity<br>**Examples:** Running a marathon, adventure race, triathlon | **Fuel:** 60-90g of carbohydrate/hour from a variety of foods<br>**Examples:** Sports drinks, gels, energy bars // Food items that provide a source of carbohydrate and protein: PB + honey wrap, chocolate milk, jerky, cheese stick<br>**Tip:** Research indicates if only one type of sugar is consumed during exercise, the absorption is limited by the capacity of one type of transporter in the intestines. Consuming a variety of foods during exercise (i.e. fruit, juices, electrolyte drinks, etc.) allows up to 100g of carbohydrate/hour to be absorbed and utilized. |

Table 2 provides a repertoire of carbohydrate-containing foods to draw from when creating your during-activity fueling plan. An additional tool to reference for carbohydrate content includes the nutrition fact panels on food packages (i.e. containers of dried fruits, sport gels/convenience items). When using these panels, remember to subtract the grams of fibre from the total carbohydrate amount, since your body does not absorb fibre and use it for energy. Reference Table 1 to determine how much carbohydrate you will require, depending on the length and intensity of your training session or event. Do not explore new fueling options the day of your event! Take new foods to trial during practice to be safe and in tune with your body.

Table 2. Carbohydrate content of common foods by food category

| Food | Amount | Carbohydrate |
|---|---|---|
| **FRUIT**<br>**Dried fruit is a concentrated form of the fresh fruit (without the fluid content), therefore you will see below that the carbohydrate content is much denser than the fresh fruit counterpart. In other words, you are able to get more grams of carbohydrate within dried fruit for a comparable volume/serving size of fresh- as tolerated.* | | |
| Raisins | 1/3 cup | 43g |
| Prunes, dried | 3 prunes | 15g |
| Banana | 1 medium | 27g |
| Apricots, dried | 10 halves | 26g |
| Apple, dried | 1 dried | 20g |
| Orange | 1 medium | 18g |
| Dates, dried | 5-6 | 30g |
| **VEGETABLES**<br>**The vegetables that serve up carbohydrate as an energy source are sweet, starchy vegetables. You won't find leafy greens listed below as a go-to source of carbohydrate during activity! Broccoli is included below as a comparator against sweeter veggies, such as corn.* | | |
| Corn | 1/2 cup | 21g |
| Winter squash | 1/2 cup | 15g |
| Mashed potato | 1/2 cup | 15-20g |
| Peas | 1/2 cup | 13g |
| Carrot | 1 medium | 7g |
| Broccoli | 1/2 cup | 5g |
| **BREAD-TYPE FOODS**<br>**Items below can be prepared as combo items (i.e. tortilla with honey or jam and peanut butter) for longer, intense activity*<br>***For these items, the carbohydrate content varies depending on the brand and type of product. Read the label and reference Table 1 for guidance on how to incorporate these items.* | | |
| Bagel | 1 | ~50g |
| Tortilla | 1 large | ~30g |
| English muffin | 1 | ~26g |
| Bread, rye | 1 slice | ~14g |
| Graham crackers | 2 squares | ~12g |
| **BREAKFAST CEREAL**<br>**Read the product label for carbohydrate information*<br>***For during activity, aim for lower fibre (less insoluble fibre/roughage) to reduce risk of digestive upset and slower availability of digestible carbohydrate.* | | |
| Oatmeal, maple/instant | 1 packet | ~33g |
| **SWEETS/CONVENIENCE FOODS**<br>**Read the product label for carbohydrate information* | | |
| Fig bars | 3 bars | ~33g |
| Sugar (blackstrap molasses, honey, maple syrup) | 1 tbsp honey | ~17g |

In wrapping up intra-activity fueling, don't forget hydration and protein! The final row in Table 1 suggests building a repertoire of mixed carbohydrate and protein snacks to ensure your body has access to a pool of amino acids (protein building blocks) to help fuel and repair muscles during endurance sport. Visit the recovery section for specific ideas on protein sources you may wish to include within a longer training session or event. Reference your hydration plan (i.e. "Hydration Tracking") for your tailored plan on maintaining hydration during activity.

Table 3. Fueling plan during exercise

| Tried and True Carbohydrate Foods | Carbohydrate Foods to Trial During Exercise |
|---|---|
| **Include a protein source for longer bouts of activity – Table 1* | |

**Recovery Fueling**

What you eat following your activity is critical for supplying your body with nutrients necessary for recovery and training adaptation. Post-activity nutrition is often the most neglected due to poor access to food after activity and the desire to rest and relax after a long bout of exercise. Specific components of recovery nutrition include:

1. **Replenish** muscle glycogen (storage form of carbohydrate found in your muscles) after activity
   - It takes 24-48 hours to fully replenish your glycogen stores if they have been depleted through your activity
   - As a rule of thumb, eat 0.5g of carbohydrate per pound of your body weight

   - 0.5g x _____ lbs = _____ g carbohydrate at post-activity meal
   - Speak with your dietitian about what Performance Plate model is appropriate before and following your workout at mealtimes to ensure your glycogen stores are replenished

2. **Repair** and regenerate muscle with high quality protein
   - As a rule of thumb, eat 15-25g protein (*see Table 5 for ideas)
   - Your muscles are responsive to protein 24-48 hours after a resistance training session

3. **Reinforce** muscle cells and immune system with colorful and antioxidant-rich foods
   - Examples include: Fruits, vegetables, whole grains, fish, nuts and unrefined olive oil
   - As a rule of thumb/stretch goal, aim for at least 2 cups of fruit and 3 cups of vegetables daily
   - Utilize the appropriate Performance Plate model to obtain your antioxidants!

4. **Rehydrate** with fluid and electrolytes
   - As a rule of thumb, your post-activity hydration plan should involve replenishing your body weight lost during training (if any)
   - Example: Replace fluid loss by drinking 3 cups (750mL) of fluid for every pound of body weight lost
   - Utilize your "Hydration Tracking" worksheet with your dietitian when discussing how to minimize fluid loss

   - 750mL x _____ lbs (lost) = _____ mL of fluid post-activity

When building your fueling plan after activity, some experts recommend aiming for carbohydrate and protein in a ratio of 3-4g of carbohydrate to 1g of protein. Without getting too nit-picky, the idea is to eat primarily carbohydrate with 15-25g high quality protein (see above as part of "repair" component of recovery). Table 4 contains considerations for refueling, depending on the intensity of the activity.

Table 4. Key considerations for refueling timing

| Exercise Intensity | Key Considerations |
|---|---|
| Light training session<br>**Examples:** Skills/drills, yoga, stretch, recovery day, weight loss phase | Next meal or a small post-training snack (carbohydrate and protein source) is sufficient |
| Moderate-high intensity training session<br>**Examples:** High volume or intensity training, heavy lifting, competition, multi-day training bouts | Refueling with the 4 Rs of recovery (see above) will facilitate training adaptations // If you have 2-3 training sessions in a day, eat recovery snacks post-training and enjoy a meal within 2 hours |

Table 5 displays carbohydrate and protein choices with varying levels of each nutrient to help you select food combinations for a post-workout meal or snack. Utilize the resources within the Recovery Nutrition portion of this handout to compile a list of post-activity meals and snacks for your fueling plan in Table 6.

Table 5. Recovery meal/snack combination ideas

| Protein (15-20g) | Protein (20-25g) | Carbohydrate (15-30g) | Carbohydrate (45-60g) |
|---|---|---|---|
| ○ 2c milk (cow, soy)* | ○ 3c milk (cow, soy)* | ○ 1 c/piece fresh fruit | ○ 2-3 c/piece fresh fruit |
| ○ 3/4 – 1c Greek yogurt* | ○ 1 1/2c Greek yogurt* | ○ 1/4-1/2c dried fruit | ○ 3/4-1c dried fruit |
| ○ 3/4c cottage cheese | ○ 1 1/2c cottage cheese | ○ 1c fruit juice | ○ 2c fruit juice |
| ○ 2 string cheeses | ○ 3 string cheeses | ○ 1c chocolate milk | ○ 2c chocolate milk* |
| ○ 1c firm tofu | ○ 1 1/4c firm tofu | ○ 1/2c oatmeal | ○ 1-1 1/2c oatmeal |
| ○ 2-3 cooked eggs | ○ 3-4 cooked eggs | ○ 1-2 slices bread | ○ 3-4 slices bread |
| ○ 2-3oz deli meat | ○ 3-4oz deli meat | ○ 1/2 bagel | ○ 1 bagel |
| ○ 1 1/2c Kefir* | ○ 2-2 1/4c Kefir* | ○ 1 English muffin | ○ 2 English muffins |
| ○ 1 1/2oz jerky | ○ 2-2 1/2oz jerky | ○ 1 granola/cereal bar | ○ 4 fig bar cookies |
| ○ 2-3oz fish | ○ 3/4-1c nuts or seeds* | ○ 2 x 6” tortilla | ○ 2 x 8” tortillas |
| ○ 1/2c nuts or seeds* | ○ 1c edamame | ○ 1/2-3/4c rice | ○ 1-1 1/2c rice |
| ○ 1/2-3/4c edamame | ○ 1-1 1/2c beans/lentils* | ○ 1/2-1c quinoa/beans/ lentils/pasta* | ○ 1 1/2-2c quinoa/ beans/lentils/pasta* |
| ○ 4 tbsp nut butter* | ○ 1 scoop whey protein | ○ 4 tbsp nut butter* | |
| ○ 1c beans* | | | |

*These protein sources contain at least 15g of carbohydrate
*These carbohydrate sources contain at least 10g of protein

Table 6. Fueling plan after exercise

| Tried and True Post-Activity Meals/Snacks | Post-Activity Meals/Snacks to Trial |
|---|---|
| | |

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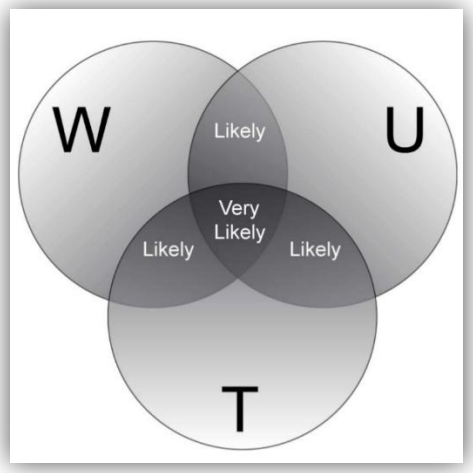
References
Nancy Clark’s Sports Nutrition Guidebook
Plant-Based Sports Nutrition – D. Enette Larson-Meyer & Matt Ruscigno
United States Olympic Committee

## HYDRATION ASSESSMENT TRACKING

Hydration is one of the most critical components of an athlete's nutrition plan. During exercise, fluid is lost through the skin as sweat and through the lungs while breathing. Dehydration can result when fluid is not adequately replaced at regular intervals before, during and after training and competition. Inadequate fluid can decrease blood volume, which may lead to reduced blood pumped with each heartbeat, less oxygen received by muscles, exhaustion which leads to poor performance and failure of the body to properly and regularly excrete by-products of exercise.

**WUT is up with my Hydration Status?**

A simple and effective method of self-monitoring hydration status and changes (throughout the day, differences between workouts) is reflected by the Venn Diagram to the right. Overlap in 2 or 3 positive dehydration screens indicates increasing likelihood of being under-hydrated.




**W** = Weight

To obtain the most accurate sweat volume/rate, follow the steps below:

1. Hydrate before your workout (aim for light coloured urine). Being dehydrated can affect your normal sweat volume/rate.
2. Take a nude body weight before the workout and add to chart on page 2.
3. Exercise for the amount of time being assessed for hydration requirements (i.e. normal workout intensity/duration).
4. If any water is consumed, calculate the difference before/after activity and add to chart on page 2.
5. Post-exercise, take another nude body weight and add to chart on page 2.
6. Calculate sweat loss (mL) using the following equation (divide by exercise time in hours to obtain the sweat rate):

= change in body mass **(g)** + fluid intake **(mL)** – urine losses **(g)**

Change in body mass (grams) = pre-exercise weight – post-exercise weight
Fluid intake (mL) = weight of water before – weight of water after
Urine losses (g) = pre-washroom weight – post-washroom weight

*If you lose more than 1% of your body weight, you likely consumed too little fluid during exercise. If you gained weight, you drank too much (this can be dangerous).


**U** = Urine colour

Compare urine colour to the chart on the right. A state of hydration presents as lemonade-coloured urine.

**T** = Thirst

The absence of thirst does NOT indicate the absence of dehydration. That said, the presence of thirst is an indication of dehydration and the need for fluid. To be more accurate, use this indicator as part of the Venn Diagram assessment.

Following a thorough assessment of hydration status, an appropriate hydration strategy can be tailored to the individual athlete. A comprehensive hydration strategy involves a plan to achieve the following:

1. Ensure adequate hydration status **prior to** exercise
2. Minimize fluid loss **during** exercise
3. Properly replace fluid loss **following** exercise

Follow up with your dietitian after you have completed the hydration assessment to determine strategies to help you achieve the above hydration goals.

| Hydration Assessment Using WUT Markers | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date/Exercise Type/Duration** | **Weight (pre-exercise) (lb)** | **Weight (post-exercise) (lb)** | **Weight Change (lb) (g)** | **Fluids (+ mL) Urine loss (- g)** | **Total Sweat Loss** | **Thirsty (post-exercise) (Y/N)** | **Urine Colour in morning (use chart)** |
| **Example:** 2019-12-22 Swim (2hrs) | 146lb | 142lb | 4lb lost (1,814.4g) | + 0mL - 0g | 1,814.4g 2.7% loss | Yes | Dark yellow |
| **Comments:** - Very likely dehydrated (based on Venn Diagram), especially since body weight lost through sweat was >2% - Need to discuss plan to drink more during and after exercise with my dietitian | | | | | | | |
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| **Comments:** | | | | | | | |

References
Cheuvront, S.N. & Sawka, M.N. (2005). Hydration assessment of athletes. *Sports Science Exchange,* 18(2), 1-12.
Korey Stringer Institute, University of Connecticut. *Hydration.* (Reviewed 2019-08-11). Retrieved from: https://ksi.uconn.edu/prevention/hydration/#
Image 2 from: United States Anti-Doping Agency