Gut Health

for Female Athletes

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Introduction

Gastrointestinal (GI) complaints among athletes include upper GI (e.g., acid reflux) and lower GI (e.g. constipation or loose stool) symptoms, and can be caused by a multitude of factors such as under fueling, underlying GI disorders (like celiac or Crohn's disease), malabsorption, or inappropriate fueling around exercise. The etiology of exercise-induced GI symptoms is multifactorial, and can occur due to many factors, including training status, exercise type, nutritional status and fueling. Research has shown anywhere between 30-90% of athletes suffer from GI symptoms ranging from bloating to constipation, loose stool and more, with symptom severity and occurrence found to worsen with higher intensity exercise. GI issues and complaints are extremely common among female athletes with research reporting a greater prevalence of GI symptoms at rest, when compared to male athletes, but not during exercise. Female athletes also report greater incidences of GI complaints during menstruation.

Furthermore, there appears to be a relationship between female sex hormones (e.g., estrogen), the gut, and the brain. However, more research is needed regarding the link between these biological processes and how it might affect female athlete gut health.

The gastrointestinal (GI) tract

The GI tract consists of the mouth, esophagus, stomach, small and large intestines, and the rectum (Figure 1). The main functions of the GI system include ingestion and digestion of food, absorption of nutrients, water and enzyme secretion, and excretion of waste products.

GI issues during exercise

Exercise-induced GI symptoms (Table 1) can occur due to a number of factors such as reduced blood flow to the gut during exercise, mechanical stress and stress response. The extent of symptoms experienced can be dependent on variables such as the exercise intensity, duration and modality, the environmental conditions and dietary intake. As a result, gut function and motility are reduced, as well as nutrient digestion and absorption.

Table 1: Exercise-induced gastrointestinal symptoms

Upper abdominal symptoms	Reflux/heartburn
	Belching
	Bloating
	Stomach pain/cramps
	Vomiting
	Nausea
Lower abdominal symptoms	Intestinal/lower abdominal cramps
	Flatulence
	Urge to defecate (urgency)
	Diarrhea

The gastrointestinal tract

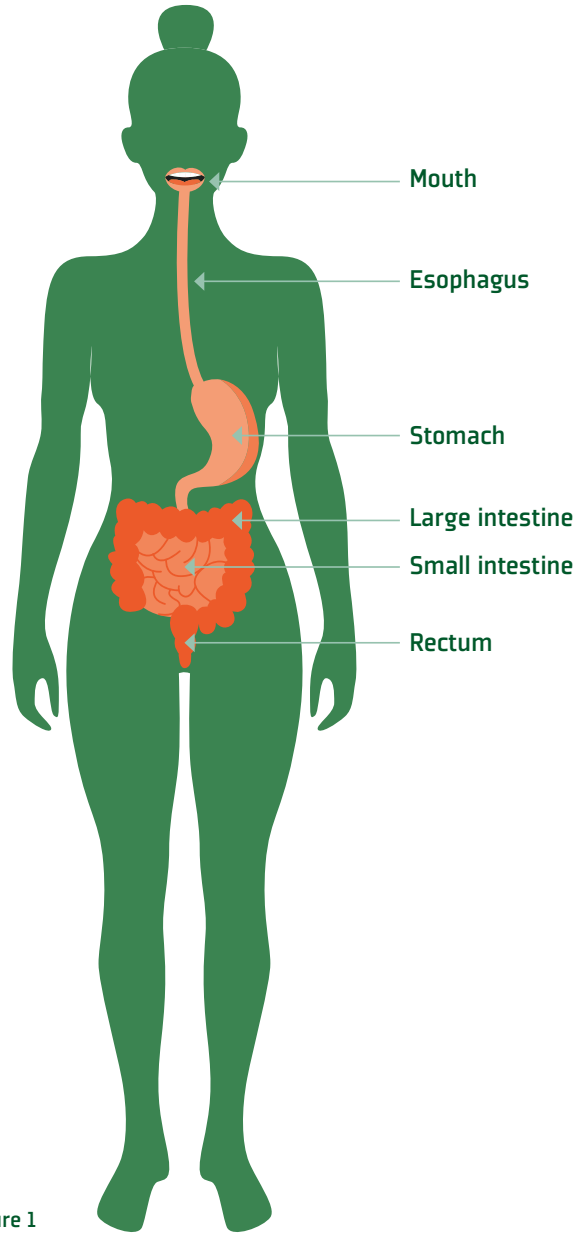

Figure 1

The following information will discuss common upper and lower GI symptoms and diseases, food intolerances, as well as practical advice for practitioners working with female athletes who are experiencing GI complaints.

Upper GI symptoms and treatments

Gastroesophageal reflux disease (i.e., acid reflux)

This is the most prevalent upper GI complaint in athletes. It occurs when acid from the stomach backs up into the esophagus, which can cause a burning sensation in the esophagus, feelings of nausea, and a sore throat. The frequency of symptoms depends on the strength of the lower esophageal sphincter and the acid production level in the stomach. Common symptoms of include:

Painful swallowing

Coughing

Heartburn

Regurgitation

'A lump in the throat'

Research has found a high prevalence of acid reflux at rest and during exercise in runners, cyclists, weightlifters, rowers, gymnasts, and American football players. However, more research is needed to understand the occurrence rates in other sports. For many athletes, changing fueling habits around exercise can help to alleviate symptoms. Consuming easier to digest foods (e.g., banana vs. acid producing foods such as citrus or chocolate) on higher intensity training days can help to decrease symptoms. In addition, athletes should be encouraged to consume low fat and low fiber meals prior to exercise as opposed to high fat and high fiber meals.

Nutrition and mental health interventions include:

- Working with a sports dietitian to find trigger foods for symptoms
- Being mindful of single sitting high fat meals
- Being aware of speed of meal and snack consumption
- Waiting 1-2 hours before laying down horizontally after eating
- Increasing water consumption throughout the day
- Decreasing stress
- Reducing caffeine and alcohol consumption
- Being mindful of non-steroidal anti-inflammatory (NSAID) use as this has been shown to cause increase symptoms
- Reducing the consumption of acidic foods such as tomatoes, tomato sauce, and spicy foods
- Hypnotherapy or meditation

If nutritional or mental health interventions do not alleviate symptoms, then the most common treatment is proton pump inhibitors which can help reduce acid production. However, it is important that an athlete consults a primary care physician or Gastrointestinal (GI) Doctor to discuss utilizing this medication.

Gastroparesis

Gastroparesis is defined as delayed motility of the stomach which causes changes in stomach emptying and digestion. The vagus nerve controls how food moves through the digestive tract. When the vagus nerve and stomach are functioning normally, the stomach should produce wave-like movements, known as peristalsis, which helps food move from the stomach toward the pyloric sphincter and into the small intestine where digestion continues. Gastroparesis occurs when the vagus nerve is damaged and/or stops working, which causes food to move too slowly, or it can stop moving completely (Figure 2).

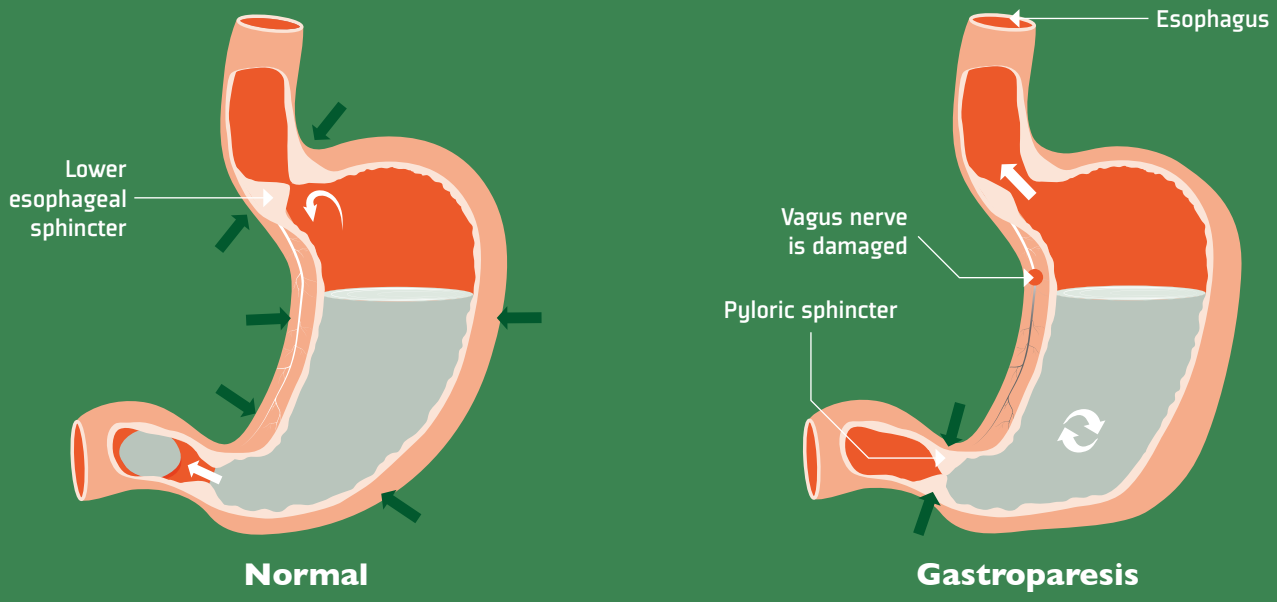

Figure 2: The stomach during normal functioning and gastroparesis

Potential symptoms of gastroparesis

- Bloating*
- Early satiety*
- Abdominal pain
- Abdominal distention
- Gas
- Constipation
- Loose stools
- Acid reflux
- Perception of consuming a "very large meal" when it was either normative or small
- Feeling full for long periods of time
- Nausea or vomiting

*most common symptoms

Diagnosing gastroparesis

Gastroparesis can be diagnosed medically through a gastric emptying study. However, a gastric emptying study is not always needed if the patient is complaining of symptoms, restricting intake, and in some cases has also lost weight. Under resting conditions, females have been shown to have slower gastric emptying and colonic transit times, compared to males, thus gastroparesis is more common in females, but there is a large inter-individual variability.

Gastroparesis can be seen in all body shapes and sizes, not just in underweight athletes. In many cases an athlete will decrease their intake with the intent of minimizing symptoms, but unfortunately it may do the opposite. Diagnosis of an eating disorder/disordered eating can be seen during gastroparesis diagnosis, and therefore it should be screened for in those experiencing gastroparesis. Restrictive behaviors tend to down regulate the energy it takes to digest food, making food take longer to move through the stomach.

Managing gastroparesis

- Start with 5–6 smaller meals and work up to larger meals
- Utilize fluid calories e.g., smoothies
- Limit consumption of high fiber–containing foods (e.g., fruit, vegetables, and whole grains) while intake is increased, as they can increase fullness and bloating
- Medications such as metoclopramide can be utilized short–term to reduce discomfort while intake is increased

It should be noted that the introduction of increased intake can cause **temporary discomfort** – this process can take weeks to months. Athletes should be supported by a dietitian/medical team throughout this process.

Lower GI symptoms and treatments

Constipation

Constipation is defined by having two or more of the following symptoms, occurring at least 25% of the time over a three month period:

Feelings of incomplete stool evacuation	Lumpy or hard stool	Straining

Constipation can be attributed to numerous things including hormonal changes, gastroparesis, decreased hydration, and a low dietary intake. The Bristol Stool Chart™ is a medical diagnostic scale used to identify and classify stool into groups, and monitor bowel movements by shape and type (Figure 3). Types 1 and 2 are more difficult to pass and may indicate constipation, while types 4 and 5 are easy to pass stool.

Bristol Stool Chart™

Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7
Separate hard lumps, like nuts (hard to pass)	Sausage-shaped but lumpy	Like a sausage but with cracks on its surface	Like a sausage or snake, smooth and soft	Soft blobs with clear-cut edges (passed easily)	Fluffy pieces with ragged edges, a mushy stool	Watery, no solid piece, entirely liquid

Figure 3: Bristol Stool Chart™

Treatment of constipation

The two top priorities are:

1. **Maintaining or correcting adequate hydration status** (see 'Hydration' for more information). Of relevance, there is some research to suggest that adding electrolytes to beverages can be helpful in maintaining adequate stool output.
2. **Consuming adequate fiber per day.** It is recommended for athletes to consume 25-35 grams of fiber per day. While fiber is essential in the diet, excess fiber can also cause increased constipation risk, particularly in the setting of a slowed metabolism and gastroparesis.

It is important to provide the gut with adequate and consistent fuel for regular stool output, this includes having frequent meals that contain carbohydrates, protein, fat, and fiber. Constipation and increased intestinal transit time has been reported in those experiencing severe low energy availability, and in the context of eating disorders. If constipation becomes chronic, it is recommended that athletes work closely with a GI Doctor and sports dietitian prior to starting any over the counter regimens (e.g., osmotic laxatives, stool softeners, etc). Medication can be helpful, but it should not serve as the first line of defense when trying to resolve constipation.

Diarrhea

The evaluation of diarrhea can vary depending on sudden onset (duration), severity (how long it has been going on), and presence of additional symptoms. Treatment and course of action are dependent on the above. Acute diarrhea is >3 episodes of diarrhea for <14 days, while chronic diarrhea is when diarrhea lasts >14 days. Most research points to infection in acute cases of diarrhea.

'Runner's diarrhea' is characterized by frequent loose bowel movements during or immediately after a run. Research suggests that it is most likely caused by ischemic blood flow away from the gut. This can lead to decreased splanchnic blood flow, jostling of the intestines and abdominal contents during movement, as well as alterations to the small and large intestines, which can cause accelerated emptying.

Potential causes of acute loose stool/diarrhea in athletes

- Reduced gut blood flow during exercise
- Medications
- Carbohydrate malabsorption
- GI infections
- Various supplements
- Psychological stress/anxiety
- Ingestion of hypertonic fluids during exercise

Wilson (2020)

Treatment of diarrhea

Seeking treatment from a sports medicine team member or physician is recommended. Depending on longevity of diarrhea, other diseases such as Crohn's disease, Irritable Bowel Disease, Irritable Bowel Syndrome and Celiac disease should be ruled out.

Initially, seek GI Doctor support for:

- Total blood count
- Kidney function
- Sodium, potassium and magnesium (electrolytes)
- Stool sample: bacteria, parasites and if needed calprotecin
- Hydrogen breath test (for lactose intolerance)

For long term diarrhea, the following may be recommended:

- Celiac panel (Ttg IgA, IGg, EMA, GDP Iga and IGg)
- Ferritin, Vitamin D and B12
- SIBO breath test (hydrogen/methane)
- Further GI testing (e.g., colonoscopy)

Dietary recommendations

Short term loose stool/diarrhea	Dehydration is the first concern, therefore work on small sip rehydration with water and carbohydrate/electrolytes. If this is tolerated, slowly add food back into the diet. Recommend starting with low fat and low fiber.
Long term diarrhea	Reduce high fat and high fiber foods. Replenish fluid and electrolyes as best as possible. Make dietary changes slowly with support from a provider.
Diarrhea around exercise	Avoid beverages with high osmolality (> 500mOsm/L). Limit fiber, fat, and fructose around exercise.

Anxiety

Anxiety has been shown to cause short-term loose stool/diarrhea like symptoms in athletes. Anxiety may also be seen prior to, during, and after training and competition. Symptoms can be alleviated by an athlete making dietary changes, utilizing breathing techniques and/or receiving mental health support. Support from a sports dietitian can specifically aid athletes in hitting peak performance while dealing with symptoms.

Food intolerance

Food intolerance, also known as a food sensitivity, occurs when someone has difficulty digesting a particular food. Intolerances are regularly confused with food allergies, which involve the immune system.

Research has shown that 15-20% of the population have food sensitivities, with athletes shown to have a higher prevalence.

Potential symptoms of food intolerance

- Abdominal pain
- Loose stool and/or diarrhea
- Gas
- Bloating

Endurance athletes are identified to have more intolerances in comparison to other sports, possibly due to:

A lowered immune system (particularly in those with low energy availability)	Changes in food intake and thus changes to gut microbiota	High intensity exercise, which may decrease gastric motility and emptying

Diagnosing food intolerances

Utilizing diagnoses through a GI Doctor and/or GI Registered Dietitian is vital to understanding and discussing changes to an athlete's diet to support their training, as well as their gut health. IgG and IgE at home testing have not been shown to correctly identify intolerances or allergies. When trying to identify food allergies, it is recommended that athletes see an allergist for proper radioallergosorbent testing (RAST).

Irritable Bowel Syndrome (IBS)

There are three different subtypes of IBS, with bloating included in all three:

Diarrhea **Constipation** **Mixed**

There is a large mind-body connection in those struggling with IBS. Athletes can experience high levels of stress, which can make GI symptoms worse. When managing and treating IBS, everything that is happening within an athlete's life must be considered, i.e., factors both inside and outside of sport. Medication to support symptoms can only go so far, the athlete needs to be addressing their symptoms from multiple angles (e.g., nutritional, mental, stress management, self care, etc.)

Treatment of IBS

Research points to utilizing the elimination FODMAP diet to alleviate symptoms in those with IBS-diarrhea subtype. Alternatively, the FODMAP elimination diet has been shown to be restrictive and harder for athletes (e.g., when traveling on the road, or eating in a university dining hall), some research has shown that following the Mediterranean diet can be effective. Finally, research has shown that gut directed hypnotherapy (e.g., Nerva App) can aid in alleviating IBS symptoms. It can be completed in person, on the phone, or on a computer. Multiple studies have shown a decrease in symptoms like bloating, abdominal pain and stool symptoms with these directed breathing techniques.

It is important to be mindful of what season the athlete is in prior to starting a change in their dietary intake. This is because it could lead to an energy restriction, and thus possibly impact their performance. For example, when an athlete is in-season, food and symptom journals may be recommended, as opposed to starting the low FODMAP diet. This may help to identify 1-2 trigger foods to begin avoiding initially. More intensive dietary interventions are best left for the off-season or post-season, if possible.

Low FODMAP diet

The low FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides and polyols) diet has been shown in some cases to be beneficial when looking at intolerances in athletes. It is a big misconception among athletes that the FODMAP diet is a long-term lifestyle change, however it is meant to be used as a temporary elimination (no longer than 4-6 weeks, in most cases), followed by a systematic reintroduction period to identify what foods the body does not tolerate. Long term use of the low FODMAP diet has been shown to cause adverse reactions in gut microbiota. A dietitian should support an athlete in finding which foods could be causing GI symptoms, and when it is appropriate to implement a low FODMAP diet. It is not recommended to be utilized as a tool in athletes with eating disorders.

Probiotics and gut health

The use of probiotics in sports has been rapidly growing over the past few years, focusing on both GI symptoms and upper respiratory tract symptoms commonly seen in athletes. Athletes embark on long travel trips and experience exhaustive training loads, lack of sleep, and sometimes poor nutrition due to the demands of sport. These stressors on an athlete's body can lead to immunosuppression, oxidative stress, increased upper respiratory illness (URS), and GI disorders. Approximately 70% of antibody producing cells are located in the digestive system, meaning if the gut is compromised, the body's ability to fight off infection can be compromised.

Considerations

When assessing an athlete with GI symptoms, dietary interventions and a clinical work up should always serve as the first line of defense, and probiotic supplementation can be one potential strategy to consider. There is some evidence to indicate that probiotics can be effective and safe for both preventing and treating GI complaints, but athletes responses to probiotic interventions are very individualized. It is not a 'one size fits all' approach.

There is a large variety of probiotics available, with different doses, strains or multi strains, prebiotics added, third party testing etc. Unfortunately, symptoms may be exacerbated in some cases, particularly if there are prebiotics added and the athlete has an underlying GI condition. When selecting a probiotic, it is important to select one supportive of GI symptoms or general health. The majority of research has been conducted in male athletes, and therefore the findings may not be applicable to female athletes. Nevertheless, research does seem to show that Lactobacillus, Bifidobacterium, Enterococcus, Bacillus and Streptococcus support positive changes in athletes. They aid in reduction of fatigue and exertion, especially seen with heterogeneity of strains vs. single strain. In regard to GI health, it is recommended to work on utilizing a probiotic to support gut symptoms. For instance, many studies have shown that use of the probiotic VSL#3 can aid in diarrhea. It is always recommended that prior to starting a probiotic supplement, an athlete meets with a Registered Dietitian.

Top tips for minimizing GI symptoms in athletes

- Encourage athletes to practice fueling strategies prior to competition, ensuring to experiment with pre-, during and post-exercise nutrition strategies many times before the day of a competition.
- Athletes should avoid high-fiber foods during the days leading up to competition, and on competition day. Fiber is essential to maintain bowel regularity, however around high intensity and/or long duration exercise, it can cause GI distress.
- Athletes should avoid the overuse of aspirin and NSAIDs, such as ibuprofen. Both aspirin and NSAIDs have commonly been shown to increase intestinal permeability and may increase the incidence of GI complaints.
- Athletes should avoid high fructose containing foods around exercise, for example fruit juices. It is recommended to utilize products/foods that have sources of both fructose and glucose to minimize risk of GI complaints.
- Athletes should maintain good hydration status, as dehydration can exacerbate GI symptoms. Educate athletes on the importance of arriving at training, competition or a race well hydrated.
- Athletes should work with a sports dietitian to help create a fueling plan that works best for them individually.

Checklist for helping an athlete with GI symptoms

- [ ] Food and symptom journal

  Ask the athlete to:

  - **Log everything that they consume for 2 week days and both weekend days (including the timing of consumption). Includes foods, fluids, medications, supplements, and caffeine..**
  - **Includes and the timing of; foods, fluids, medications, supplements, and caffeine.**
  - **Log their GI symptoms (bloating, gas, diarrhea, belching, etc.) as they present; where on the body it occurs, and bowel movements using the Bristol Stool Chart™.**
  - **Log training times and duration.**

- [ ] What diet changes can be made to alleviate some symptoms?

  - **Change the timing of meals and snacks around training?**
  - **Alter the composition of meals and snacks at different points of the day?**

- [ ] Would a probiotic be helpful?

- [ ] Is the athlete taking any over the counter medications or supplements?

- [ ] Could it potentially be REDs, an eating disorder, or disordered eating?

- [ ] How high are the athletes stress levels?

  - **Mental health provider referral?**
  - **Nerva App**

- [ ] Would a consult with a GI physician be helpful?

  - **Lab tests/stool sample**

GUT HEALTH

30-90% of athletes suffer from gastrointestinal (GI) symptoms	Female athletes report greater prevalence of GI symptoms at rest, but not during exercise, compared to male athletes	Female athletes report greater incidences of GI complaints during menstruation

Common upper and lower exercise-induced GI symptoms

Upper abdominal symptoms

- Reflux/heartburn
- Belching
- Bloating
- Stomach pain/cramps
- Vomiting
- Nausea

Lower abdominal symptoms

- Intestinal/lower abdominal cramps
- Flatulence
- Diarrhea
- Urge to defecate (urgency)

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