Gastrointestinal Problems in Athletes

“Gut Check”

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Goals & Objectives

• Appreciate the pathophysiologic effects to the gastrointestinal tract caused by exercise.

• Learn the most common gastrointestinal symptoms afflicting athletes.

• Learn strategies to reduce unwanted gastrointestinal symptoms interfering with athletic performance.
GI problems in distance running


Review article
Gastrointestinal problems in distance running

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Gastrointestinal Problems in Runners
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Gastrointestinal symptoms are a common occurrence in distance runners, with symptoms varying from mild to severe. These symptoms can affect training and performance. For example, exercise-induced nausea and vomiting can affect performance in distance running events. Other symptoms may include diarrhea, abdominal pain, and constipation. The clinical consequences range from a minor nuisance to performance impairments and even potentially life-threatening bleeding. Some GI symptoms are the direct consequence of intense exercise. Athletes seeking advice or assistance with these problems are usually concerned with the interruption to training or performance impairment caused by the
Anecdotes

The most publicly notable and often quoted gastrointestinal (GI) event in sports came from Derek Clayton following his world record-setting marathon in 1979, “Two hours later, the elation had worn off. I was urinating quite large clots of blood, and I was vomiting black mucus and had black diarrhea” [1]. This is clearly a reference to the potential GI stresses following intense physical activity. My own personal anecdote came as a finish line observer to a community marathon. While I was standing near the finish, the winner was nearing the end. The crowd’s joyous greeting was followed by a curious silence. The cause of this reaction was soon apparent as the winner crossed the line with feces-coated legs and quickly disappeared to the nearest shower, missing his well-deserved victors reception.
But First, GI Benefits of Exercise

- Reduced incidence of
- Liver disease
- Cholelithiasis
- Colon cancer
- Constipation
Pathophysiology

- Mechanical agitation
- Fluid shifts
- Decreased splanchnic flow
- Dehydration
- Increased sympathetic and parasympathetic tone
- Endotoxemia
- Changes to bowel transit time
- Hormone shifts
- Autoimmune changes
Mechanical Agitation

Mechanical Body Vibrations

Lower GI symptoms

Running 2x > Cycling

Body Posture

Upper GI symptoms

Running = Cycling
Fluid Shifts

- Redistribution of Blood Flow away from the GI tract during exercise.
Cardiac Output Distribution

- 60-70% reduction to splanchnic flow in healthy subjects exercising at 70% $\text{VO}_2 \text{ Max}$

- A healthy gut can withstand a 75% reduction in blood flow for 12 hours without major histological changes.

- 80% reduction to splanchnic flow at maximal workload.

- 90% of splanchnic blood flow is for mucosal support
Absolute distribution of Cardiac Output

<table>
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<th>Rest</th>
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<th>Maximal</th>
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<td>0.72</td>
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(ml thousands)
Relative distribution of Cardiac Output

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<td>6</td>
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Fluid Balance during exercise

Gastric Emptying
15-20 ml / min
(30-40 oz/hr)

Perspiration up to 40 ml/ min
(16-50 oz/hr)

Dehydration
Absorption and effect on performance

- Gastric emptying rate
  - ↑ with increased volume
  - ↓ with CHO content

- Traditional advice - 600 to 1200 ml fluid q hour is debated due to risk of hyponatremia in some.
Neuroendocrine and Hormone shifts

- VIP - Vasoactive intestinal peptide
- Secretin
- PHI - Peptide histidine isoleucine
- Pancreatic polypeptide
- Gastrin
- Neurokinin A
- Motilin

- “Cause or Result” of GI symptoms.
GI Symptoms

- Heartburn
- Nausea
- Vomiting
- Flatulence
- Diarrhea
- Hematochezia
- Hematemesis
Prevalence of GI symptoms

- 84% in Endurance athletes
- 30%-83% of runners.
- 29% believed GI problems interfere with performance
- Women affected > Men
- Worse during the perimenstrual period
Intensity matters

- Athletes performing at 40%, 60% or 80% of maximal oxygen uptake do not report GI symptoms.

- Intensity / Time
  - Prolonged exercise even at low intensity is associated with GI symptoms
Training

• Conditioning reduces symptoms.

• Cardiovascular training changes regional blood flow in submaximal exercise.

• Less blood shifted away from gut at submaximal workload in the trained individual.
Case - bowel ischemia

- 1997 Ironman Triathlon
- Top 10 performer collapsed 50 meters from finish.
- Treated and released from medical tent.
- Following day had unremitting abdominal pain, fever, weakness admitted to hospital.
- Had 16 cm ischemic bowel resection.
Summary

The diagram illustrates the relationship between physical activity, dehydration, and the effects on the gastrointestinal (GI) tract. Physical activity can lead to neuro-endocrine changes, which in turn decrease splanchnic blood flow. This decrease in blood flow can lead to altered GI motility and transit, disturbed absorption, and an increase in GI permeability, ultimately resulting in GI symptoms. Dehydration can also contribute to mechanical effects on the GI tract, further impacting the system.
Upper GI tract

- GERD
- Nausea & Vomiting
- Gastritis and Ulcers.
- Hepatitis and Pancreatitis
GERD

- **Exercise Intensity**

- **Duration, amplitude, frequency of esophageal contractions.**

- **Weightlifters > Runners > Cyclists**

- Exercise induced GERD may or may not cause or worsen EIA.

- **GERD vs. Angina?? (middle age or older athletes)**
GERD Mechanisms

- Gastric Dysmotility
- Lower Esophageal Sphincter Relaxation
- Hormones, ie. glucagon, VIP
- Enhanced pressure gradient between stomach and esophagus, esp. weightlifting
- Gastric distention from excessive fluid intake
- Delayed Gastric Emptying
GERD Recommendations and Rx

- Avoid laying down within 4 hours of evening meal
- Head of Bed Elevation
- Avoid postprandial exercise, ie. minimum 3 hours.
- Post meal chewing gum
  - inc. saliva, reduce pp esoph acid
- RX
  - PPI
  - H2-receptor antagonists
  - Dicyclomine
Nausea and Vomiting

“you’re not working hard enough if you are not vomiting”

- Delayed gastric emptying at high levels activity.
- Dehydration, hyperthermia, mental and emotional distress.
- Probably related to hormone changes.
- Most influenced by ingestion timing.
Gastritis and Ulcers

• Mucosal lesions in the corpus similar to stress ulcers
• Gastric mucosa is highly vulnerable to ischemia, but better tolerance in the antrum.
• NSAID use, commonly used by athletes, PROBABLY increases risk
Hepatitis and Pancreatitis

- Ultramarathoners see rise in LFT’s.
- Due to fluid shifts, temperature increase?

- Pancreatitis
  - Rarely reported cases in marathoners.
  - ?ischemia, ? Mechanical trauma
“Side Stitch”

- Causes??
- Diaphragmatic
- Abdominal angina
- Median Arcuate Ligament Syndrome
Lower GI Tract

- Diarrhea / evacuation emergency
- Colitis
- Rectal Bleeding
- Anemia
- Permeability and endotoxemia
GI problems can be costly

- One elite marathoner stopped at a service station at 22 miles. She returned to the race course and won.
- However, she inadvertently trimmed 30 meters off the 26 mile course, was disqualified and lost the $41,000 prize money.
Evacuation Emergency

- Accelerated colonic transit
- The urge to defecate halts more runs than any other single reason to stop
- Exact mechanism is uncertain
- Hormone secretion, nervous output, mechanical influences, intestinal fluid secretion.
Permeability

• Intense and prolonged exercise leads to increased mucosal permeability and translocation of bacteria and endotoxins.

• 8 participants in a marathon

• Urinary excretion of $^{51}$Cr-labelled EDTA

• If NSAID’s are used there is increased permeability.
Endotoxemia and LPS

- LPS - lipopolysaccharides probably leak into the circulation at exhaustive exercise.
- May lead to release of tumor necrosis factor, interleukin 6 and other acute phase reactants.
Endotoxemia and LPS

- Case
  - College Student Hiker in Smoky Mountains
  - Several days of hiking.
  - Difficult bowel movement.
  - Felt brief sudden chill.
  - Developed mesenteric vein thrombosis
GI Bleeding

• 8-23% of runners hemoccult-positive stool.

• 85% of ultramarathoners and triathletes with hemoccult-positive stools.

• Causes
  • Ischemia
  • Mechanical irritation

• Supported by observation of lower incidence of Lower GI bleeding in cyclists and absence in race walkers.
Chronic GI Illness and exercise

- Inflammatory Bowel Disease
- May experience a flare up to symptoms during intense exercise.
- Irritable Bowel Syndrome
- Worsening symptoms
Athletic competition, even one contest, provides enough contact to spread a GI pathogen. In particular, a 1998 GI infection outbreak among the Duke University football team and staff started with **turkey sandwiches in a catered box lunch**.

Out of **108 players and staff, 54 developed an illness**, with 43 having primary infections within 10 hours of consumption. Twenty-nine players developed the illness right before or during their game against Florida State.

**Eleven players on the Florida State team developed the same GI infections**, not from eating the same food, but from playing against Duke. The 11 players developed the illness, diagnosed as a form of Norwalk virus, within 48 hours of the game [6]. Other cases have had outbreaks **in freshman dining halls**, with **102 cases reported in a single day**.
Summary Recommendations

“Toilet Training”

- Eliminate Suspect foods and slowly reintroduce them one at a time.
- Increase the time between eating and training
- Limit intake of gas-forming foods
  - Broccoli, onions, beans
- Limit high fiber foods prior to exercise.
- Avoid coffee and other sources of caffeine
Summary Recommendations

• Experiment with liquid meals before races
• Never try a new supplement or drink for the first time in a race
• Increase training volume and intensity steadily
• Avoid large doses of vitamin C, sodium bicarbonate, magnesium or carbonate drinks before races.
• If symptoms persist, then low dose loperamide may be considered.
Summary Recommendations

• Keep Well Hydrated
• Evacuate **before** exercise.
Be Alert!!

- The clinician must remain vigilant to the possibility of underlying GI pathology unmasked by exercise or masquerading as common exercise sequelae.
References


References


References


• Runner's anemia. Dang CV - *JAMA* - 8-AUG-2001; 286(6): 714-6