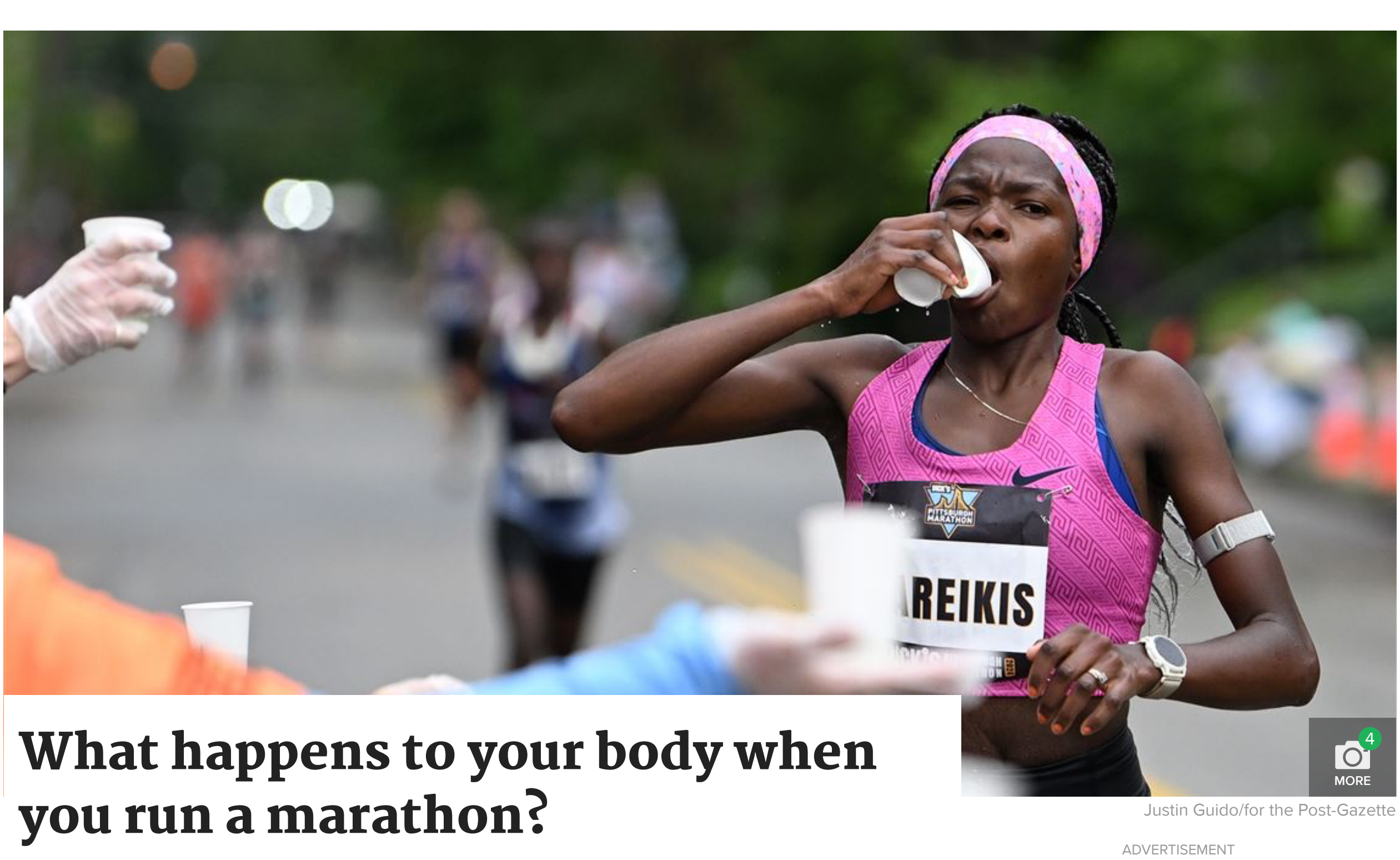
ADVERTISEMENT



MORE 4

Justin Guido/for the Post-Gazette

What happens to your body when you run a marathon?

From your heart to your muscles to your brain and your digestive system, here's what to know

HANNA WEBSTER
Pittsburgh Post-Gazette
hwebster@post-gazette.com

APR 27, 2025 4:00 AM

0

Pittsburgh's annual marathon is approaching, with an at-capacity 4,900 people — nearly 44% of whom are first-timers to a 26.2-mile race — prepared to hit the pavement the morning of May 4, according to P3R.

Over the course of that Sunday, their bodies will undergo a variety of changes, from minute damage to the muscles to shifts in blood flow to a drop in immune system function.

Here's a breakdown of what happens to the body when running a marathon.

Heart

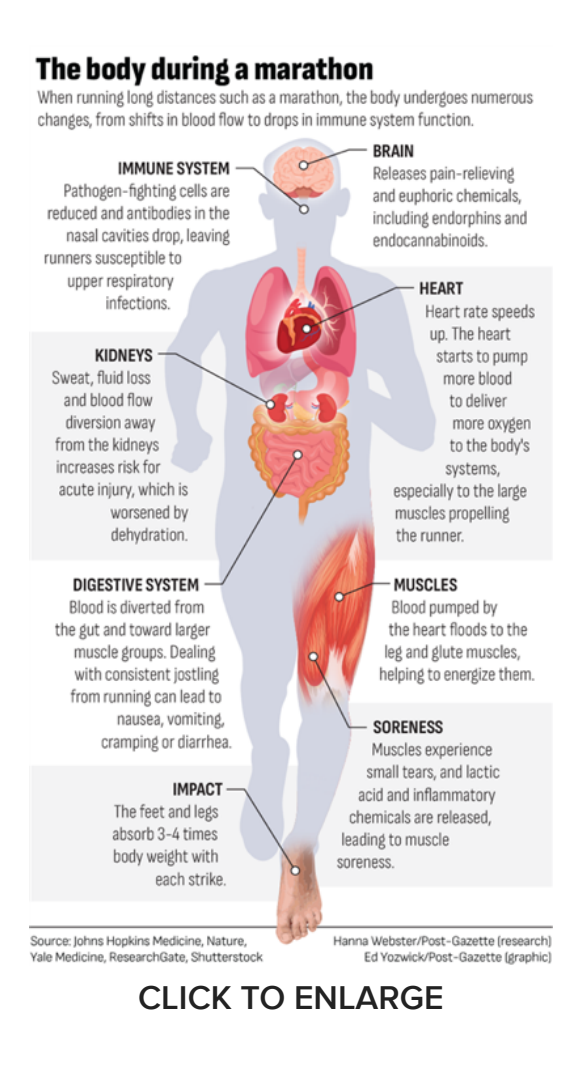
As physical exertion increases, so too does the heart rate. The heart starts to pump more blood to deliver more oxygen to the body's systems, especially the large muscles propelling the runner.

Anya Sostek
Pittsburgh Marathon launches new program for first-time runners

"It really comes down to blood flow and the body's ability to put blood where it needs it most," said Emidio (Ed) Pistilli, professor in the division of exercise physiology at WVU School of Medicine. "Major muscles need the most blood, and the heart is responding to that."

A seasoned runner will have a smaller change from their resting heart rate to their heart rate during the race as their body has adapted over the course of training, he said.

Heart attacks occurring during running have been highly publicized but are rare. Research does indeed show that those who die of heart attacks after physical exercise like running tend to have preexisting conditions, such as heart disease. Generally, running is considered heart healthy because it strengthens the muscle. Consistent running can also reduce blood pressure and keep the arteries clear of plaque.


The body during a marathon
When running long distances such as a marathon, the body undergoes numerous changes, from shifts in blood flow to drops in immune system function.
IMMUNE SYSTEM
Pathogen-fighting cells are reduced and antibodies in the nasal cavities drop, leaving runners susceptible to upper respiratory infections.
BRAIN
Releases pain-relieving and euphoric chemicals, including endorphins and endocannabinoids.
HEART
Heart rate speeds up. The heart starts to pump more blood to deliver more oxygen to the body's systems, especially to the large muscles propelling the runner.
KIDNEYS
Sweat, fluid loss and blood flow diversion away from the kidneys increases risk for acute injury, which is worsened by dehydration.
DIGESTIVE SYSTEM
Blood is diverted from the gut and toward larger muscle groups. Dealing with consistent jostling from running can lead to nausea, vomiting, cramping or diarrhea.
MUSCLES
Blood pumped by the heart floods to the leg and glute muscles, helping to energize them.
SORENESS
Muscles experience small tears, and lactic acid and inflammatory chemicals are released, leading to muscle soreness.
IMPACT
The feet and legs absorb 3-4 times body weight with each strike.
Source: Johns Hopkins Medicine, Nature, Yale Medicine, ResearchGate, Shutterstock
Hanna Webster/Post-Gazette (research) Ed Yozwick/Post-Gazette (graphic)

CLICK TO ENLARGE

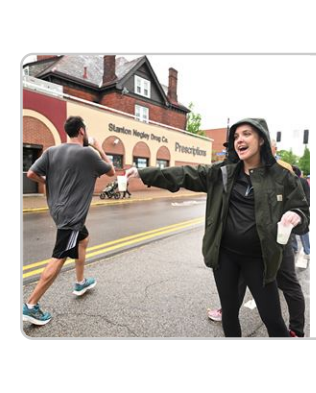
Combined with fluid loss from sweating, the impact of an overactive heart can lead to risk of dehydration and organ damage.

"When you're doing prolonged activity, you gotta make sure you're hydrating," said Brian Larouere, associate professor and program director of exercise science at Seton Hill University. "When you sweat, you're losing electrolytes and fluid, which thickens the blood. This makes it harder for the heart to pump, and your breathing gets heavier. It's all one big connected machine."

Muscles

The musculoskeletal system certainly takes a toll during a marathon, absorbing the vibrations and stress of the body's exertion.

Runners take about 30,000 steps in a marathon, said Frank Velasquez, director of sports performance at Allegheny Health Network, absorbing three to four times their body weight with each strike. This means strength training will be of great import for those preparing.



Pittsburgh Post-Gazette
Pittsburgh Marathon weekend by the numbers

"The strength of your muscles is going to help lessen the impact on your joints," he said.

During a marathon, blood pumped by the heart floods to large muscle groups, helping to energize those muscles. But as with the heart, the body can experience microscopic tears in muscles. These muscles will start to repair themselves and ultimately be better than they were before, said Jeff Fleming, primary care sports medicine physician at UPMC and an assistant professor at the University of Pittsburgh orthopaedic surgery department.

Training is crucial to prevent muscle and ligament strains and larger tears. The body will adapt to heavier exertion as a runner scales up endurance, but going too hard too quickly can lead to injury.

After a big exertion, a runner can also develop what's called delayed-onset muscle soreness, explained Larouere. Usually, this peaks around a couple days but, after a marathon, it can last up to seven days.

This happens because during a run as long as a marathon, the muscle fibers break down, and lactic acid and inflammatory chemicals are flooding the body, signaling damage. A buildup of lactic acid is generally perceived as muscle soreness.

Brain

Runners often speak of the "runner's high," when the brain receives a deluge of exercise-induced endorphins. These hormones can relieve pain and stress and boost mood.

Amanda Flurr smiles and waves as she runs on the South Side's East Carson Street during the 2023 Pittsburgh Marathon.
(Kyle Nelson/For the Post-Gazette)

But recent studies have suggested that endorphins are too large to cross the blood-brain barrier, and that it may actually be cannabinoids bodies naturally produce that are responsible for the runner's high.

These chemicals, called endocannabinoids, activate receptors throughout the brain and body and relieve anxiety, depression and pain, and can lead to feelings of euphoria. One study in men found that a stint of aerobic exercise increased both endocannabinoids and brain-derived neurotrophic factor, or BDNF, often called "brain fertilizer" for the proteins' ability to help the brain work properly.

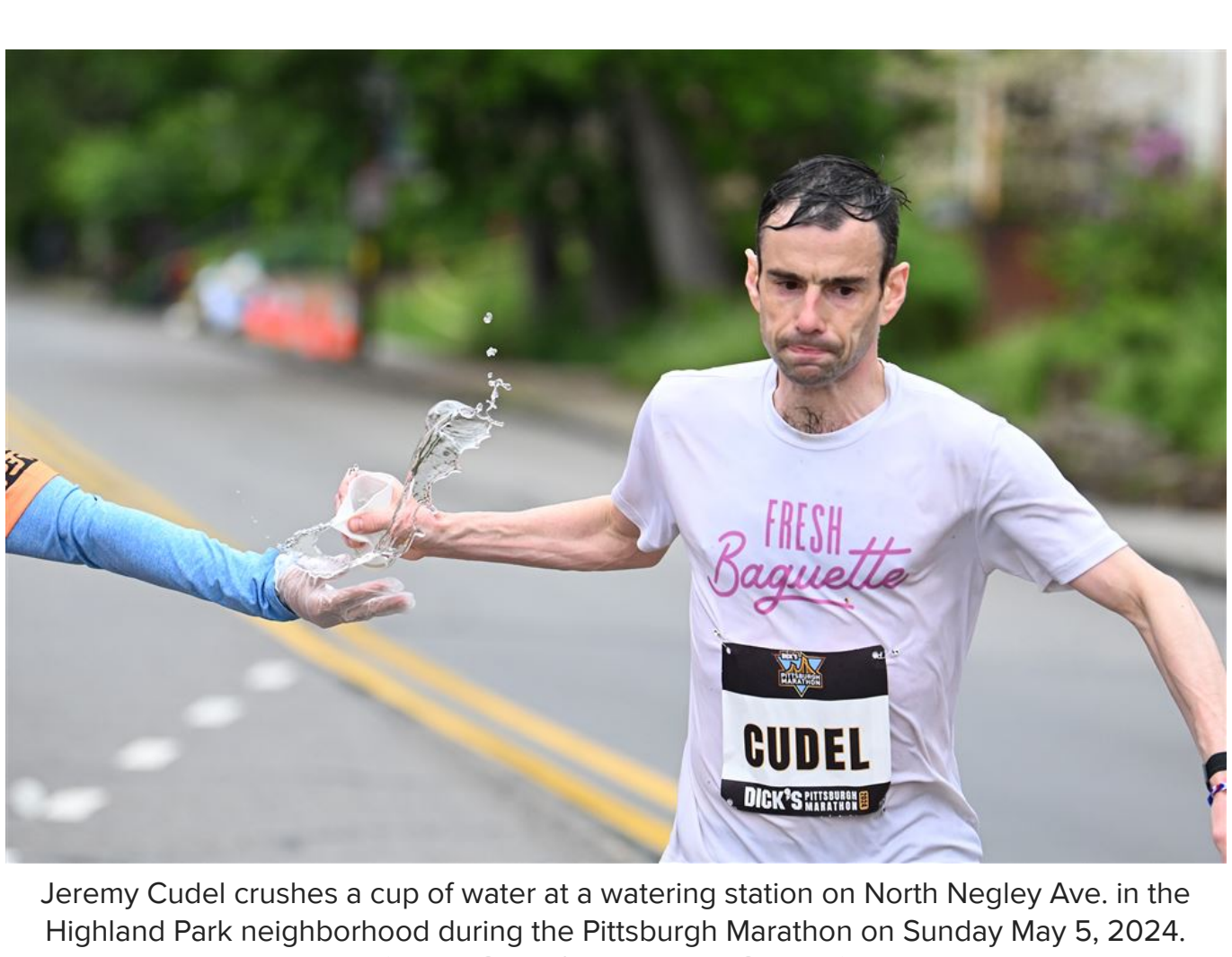
Races are always going to have some element of mental stress and challenge, said Velasquez, which may be enhanced by uncertainties in the weather. (Pittsburgh can see unpredictable rain this time of year.)

"There's a lot of alone time during a race like this, even if you think you're going to run with a partner," he said. "I've done different races where I dedicate each mile to a family member. That helped get me through it."

Digestive system, kidneys

With blood flowing toward the leg muscles and the lungs, less blood is prioritized for other bodily systems, including the digestive system and the kidneys. This may lead to feeling nauseated or crampy, or vomiting during the race.

"To me, that's a warning sign that you're going too hard," said Larouere.



Jeremy Cudel crushes a cup of water at a watering station on North Negley Ave. in the Highland Park neighborhood during the Pittsburgh Marathon on Sunday May 5, 2024.
(Justin Guido/For the Post-Gazette)

The risk for diarrhea often increases during marathons, in part from the continual jostling of the digestive system, dehydration and reduced blood flow.

Eating a big meal right after a long race may also lead to uncomfortable symptoms.

"Your digestive tract is kind of in shock," said Velasquez. "All your energy has been expended for muscle function. The last thing you want to do is go out and have a big spaghetti dinner or get intoxicated."

Velasquez has run four marathons and said he enjoys grabbing a beer after the race, but will take it easy for the rest of the day, making sure to rehydrate with fluids and electrolytes and eating light food, like a banana, until later in the day.

One 2019 study conducted by Yale researchers found that 82% of runners whose blood they sampled tested positive for acute kidney injury. This was associated with sweat loss, leading to an imbalance in nutrients like sodium and causing stress on the kidney.

This condition is rare and reversible, but it highlights the importance of hydrating properly before, during and after the race to prevent further injury.

Immune system

Studies show that the immune system is temporarily compromised for about a week after a big race, those interviewed for this story said. It has just used up all its stores to help a runner cross the finish line and will be depleted.

"A marathon in itself is a pretty big insult to the body," said Pistilli. "People training for one are generally pretty fit, have a better immune system and lower risk of cardiovascular disease, but this one act of prolonged activity is really going to affect most runners in a negative way."

Pathogen-killing immune cells are reduced, said Pistilli, as is the antibody IGA, which typically lines the nasal cavities, leaving a runner at a higher propensity for an upper respiratory infection.

There's even a term for it: "marathon flu." Getting proper sleep, meals and hydration the week before and after a big race can help reduce this risk.

The importance of training

"Running a marathon, overall, is not for the faint of heart," said Larouere. "I have conversations with individuals all the time, where I tell them, 'You gotta train ahead of time. You don't just wake up and run a marathon.'"

Velasquez specifically recommended strength training to improve the body's ability to absorb shock and weight impact, protect the joints and prevent too much muscle wear and tear. Aim to run two to four times a week, with two days a week of strength training.

It's generally good to practice being in discomfort, but it's also important to listen to the body.

The body "gets stronger after doing hard things," said Fleming. "Just be mindful that you can overdo it and cross a line. As you train, you get better at figuring out where that line is."

And if 26.2 miles doesn't sound like a fun challenge — that's OK too.

"Running is a good activity, but it's not for everybody," said Velasquez. "That's why we have activities like biking, swimming and walking the dog. ... I know plenty of people who are in great shape and have never run a race in their lives."

First Published: April 27, 2025, 4:00 a.m.
Updated: April 27, 2025, 10:32 a.m.

Tags: 2025 Pittsburgh Marathon

Hanna Webster has covered health for the Post-Gazette since 2022, specializing in health equity and the opioid crisis. She holds a master's degree in science writing from Johns Hopkins University.

hwebster@post-gazette.com
@hannamwebster
hannamwebster.bsky.social

ADVERTISEMENT

YOUR CARE SHOULD BE LIFE CHANGING
UPMC
LEARN MORE

LATEST NEWS

- Trump's first 100 days divide Pennsylvania supporters and critics
- What happens to your body when you run a marathon?
- Gaza Health Ministry reports 51 deaths from Israeli strikes, bringing overall toll to over 52,000
- International students stripped of legal status in the U.S. are piling up wins in court
- Historic artifacts spared in fire at Pennsylvania Governor's Residence

SPONSORED MESSAGE
Enlarged Prostate Has Nothing To Do With Age: Just Stop Doing This One Common Thing
By Natural Healthy Way

ADVERTISEMENT

YOUR CARE SHOULD BE LIFE CHANGING
UPMC
LEARN MORE

Customize your free Newsletter Preferences

Email Preferences

Archives	PGe
Advertising	RSS Feeds
Email Newsletter	Corrections
Products & Services	Help
Contact Us	Terms of Use
Subscribe	Privacy Policy
Subscriber Services	About Us

Copyright © 1997-2025 PG Publishing Co. All rights reserved

Popular in the Community

Join the Conversation

Commenting policy | How to Report Abuse

If you would like your comment to be considered for a published letter to the editor, please send it to letters@post-gazette.com. Letters must be under 250 words and may be edited for length and clarity.

Conversation

5 Viewing

April Kaull

AK Be the first to comment...

No one seems to have shared their thoughts on this topic yet

Leave a comment so your voice will be heard first.

Powered by OpenWeb Terms | Privacy | Feedback

For adults with moderate to severe ulcerative colitis (UC) in whom tumor necrosis factor (TNF) blockers did not work well or cannot be tolerated.

Are UC symptoms trying to slow you down?

AdChoices Sponsored

MUST READ

- SPORTS Steelers grab 'explosive' RB Kaleb Johnson in 3rd round of NFL draft
- NEWS Pittsburgh Marathon launches new program for first-time runners
- NEWS 'On final approach': New Pittsburgh International Airport terminal is 90% complete

TRENDING

1. SPORTS Jason Mackey: Steelers clearly had a type in this year's NFL draft
   Sun, Apr 27, 2025, 4:00am Jason Mackey
2. SPORTS 3 takeaways: Derek Shelton's bullpen decision costs Pirates against Dodgers
   Sun, Apr 27, 2025, 4:00am Colin Beazley
3. SPORTS For 'Pennsylvania kid' Will Howard, the wait was worth it when the Steelers called
   Sat, Apr 26, 2025, 6:49pm Ray Fittipaldo
4. SPORTS Steelers sign first batch of undrafted free agents
   Sat, Apr 26, 2025, 10:04pm Christopher Carter
5. BUSINESS How big purchases in retirement can cause retirees to run out of money
   Sun, Apr 27, 2025, 4:00am Tim Grant