How to reach your performance potential throughout the menstrual cycle

Serena Blacklow

2024

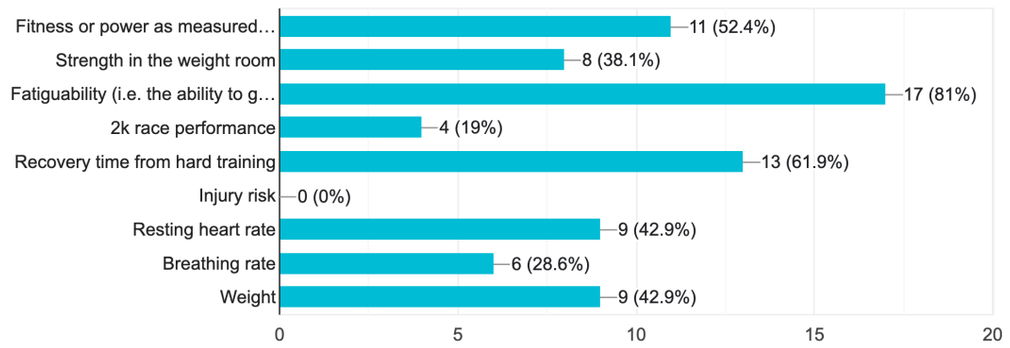
My background – grew up in Cambridge, was lightweight rower, also coach at BU and had this discussion with that team too, went to med school, but not your doctor. This ppt has some facts (cited), some opinion from me as a coach based on things I've synthesized from the literature and heard or read about from other experts. Special thanks to Dr. Megan Roche (Stanford) and Dr. Kelsey Conrad (Smith) for content and format feedback.
For the purposes of this talk, females are people who have an underlying cyclical hormone profile.
Research shows that 30-70% of female athletes feel that the menstrual cycle subjectively impairs their performance. We'll see as we go forward that, objectively, there is no evidence that the menstrual cycle adversely affects performance, but more likely it may affect recovery. (https://onlinelibrary-wiley-com.ucsf.idm.oclc.org/doi/epdf/10.1111/sms.13818)

Photo: https://www.independent.co.uk/life-style/emma-pallant-browne-period-swimming-b2351414.html (notice bleeding at bottom of her triathlon suit)
Emma Pallant-Browne on her way to 4th place at professional triathlete long-distance triathlon. Her response: "to edit it means there is something wrong with it" when it's a major marker of female health. "It's natural and ... growing up where I didn't have my period, I now see it as beautiful. So if you have a photo like this, save it, cherish it**, remember how you performed on a tough day** ..."
Other examples of
- athletes winning on period: Mikaela Shiffrin – wins over lindsey vonn earlier this year in interview saying exhausted bc of cycle
- athletes struggling because of period-related symptoms: Salpeter – pulled out of Tokyo marathon citing cramps; Fu Yuanhui Chinese swimmer citing cramps and tiredness felt didn't swim well 4x100m relay 2016 Rio olympics

Almost 30% (28.6%) of you are not comfortable talking about this stuff with coaches.

Have 35 people: 21 responded → 60% response rate

Do you feel like the menstrual cycle affects any of the following metrics for you personally?

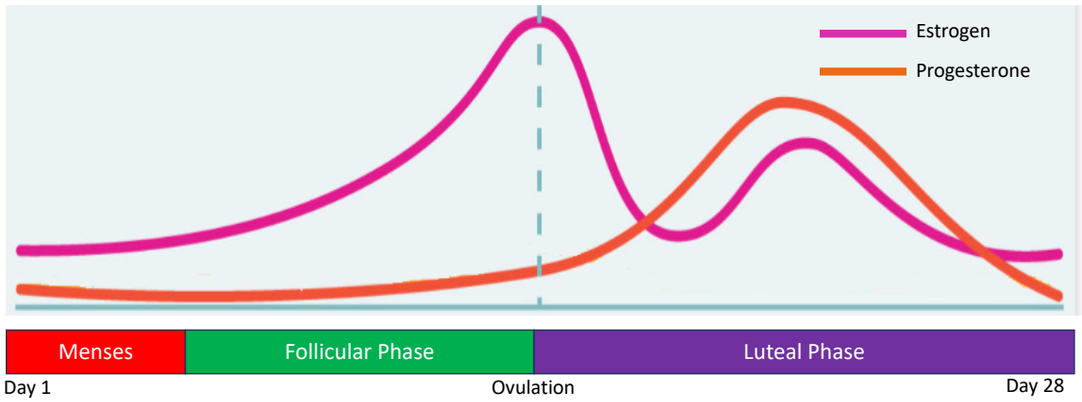


Other comments on physical side of performance: overall more tired, increased stiffness, back pain, nausea that makes fueling hard especially for morning practice, bad cramps that make it hard to even move, heart rate higher

Other comments on mental side of performance: makes mental focus difficult, decreases toughness, increases self-doubt, makes depression worse, emotional rollercoaster, low motivation or interest in training

21 responses (?response rate, you care!) -- For a baseline, ~60% you track your menstrual cycle. Most of you who do track it don't look at it together with your training journal. Nearly all of you who responded have a training journal, so that's a great first step.

Menstrual cycle basics



Start with a "normal" cycle i.e. no contraception, no energy deficiency
Lasts 21-45 days

What is the pink line?
Estrogen → main effects: increases fat oxidation, decreases tendon and ligament stiffness, unclear effect on protein synthesis and muscle growth

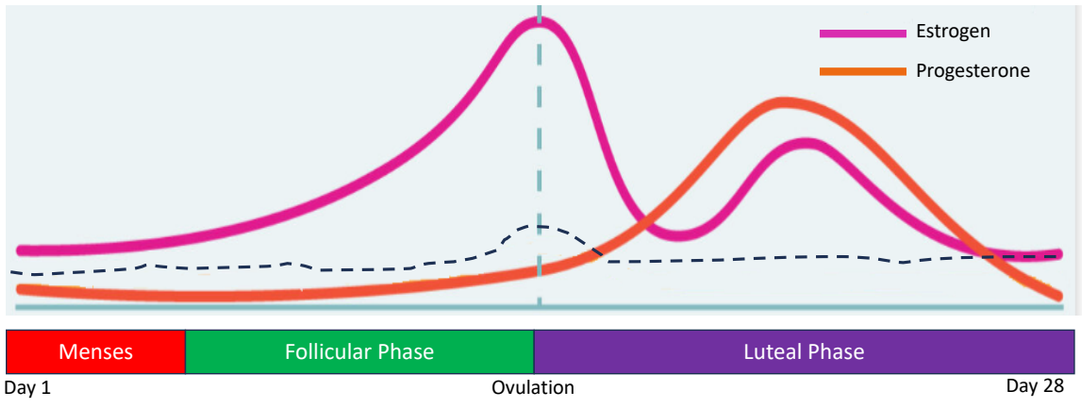
What is orange line?
Progesterone → unclear exact effects on carb vs fat metabolism, raises base body temperature

Menses: both low
Follicular: estrogen higher
Luteal: progesterone higher

Lots of the research is variable in what phases they compare – there's "foll vs lut", "early foll vs late foll", "ovul vs mid lut", "early lut vs late lut vs mid fol", etc). Makes it really hard to compare studies. Also super low sample sizes. ALSO very hard to know exactly what phase someone is in unless you're doing blood and ovulation tests (many studies instead incorrectly assume a 28-day cycle for all participants and/or use self-reporting)

Image: https://www.bee3fitness.com/nourishing-performance-blog/2021/10/19/using-your-cycle-as-a-guide-for-sport-performance

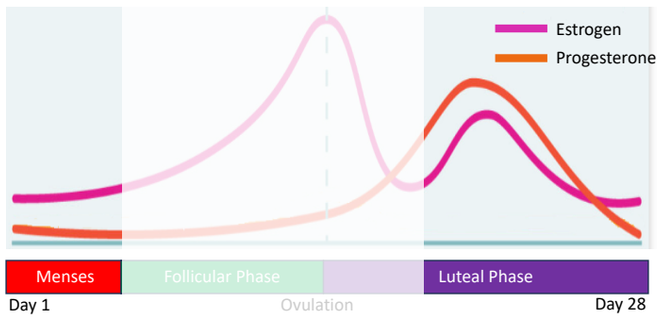
Menstrual cycle basics



Testosterone (dashed black line) also has a small peak around ovulation. I haven't seen it mentioned in any studies or measured as a confounder, not sure why… perhaps hard to measure… will let you know if I find out q

Image: https://www.bee3fitness.com/nourishing-performance-blog/2021/10/19/using-your-cycle-as-a-guide-for-sport-performance

Common symptoms of late luteal phase and menses



Mood changes (e.g. sadness, irritability)
Bloating, (water) weight gain
Faster breathing rate
Tiredness/lethargy
Appetite changes
Diarrhea or constipation
Cramps
Worse sleep quality
Lower back pain
Headache
Breast pain/swelling
Higher body temperature (0.5F)

Whether or not you feel all or some of these, there's a lot of stuff to feel and it's real, not your imagination. Varies a lot person to person, it's hypothesized that people have varying sensitivities to the hormones (rather than producing more or less of a hormone), but it doesn't seem that there is a consensus as to why yet. It also can vary a lot *within* a person as well. Maybe you don't get a headache every time, or maybe you don't get cramps every time, and maybe as you get older symptoms will change. If you aren't experiencing any symptoms and/or have an irregular bleeding cycle, that could be a red flag that something else is going on and rec seeing a doc.

Weight gain potentially due to increased aldosterone and increased capillary permeability (e.g. causing ankle swelling, breast swelling, bloating) (https://www.ahajournals.org/doi/pdf/10.1161/HYPERTENSIONAHA.107.107136)
Symptoms: https://www.apa.org/monitor/2023/09/emerging-science-severe-pms (APA review of PMS, 2023)
Motivation: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9328165/#:~:text=Two%20studies%20found%20statistically%20significant,in%20the%20menstrual%20phase%20(vs. (The Effect of Menstrual Cycle on Perceptual Responses in Athletes: A Systematic Review With Meta-Analysis, 2022, Frontiers in Psychology)

- Write down one thing that makes you uncomfortable at any point throughout the cycle. If you don’t have a specific thing currently, write down one thing you experienced in the past.

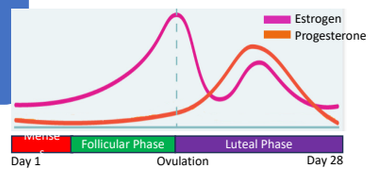
Activity: write down one thing that makes you uncomfortable at any point throughout the cycle and one thing you will do to mitigate the discomfort. If you don’t have a specific thing, write down one thing you will apply from this to your training or recovery all the time!

Example: bloated, bad cramps, feel unmotivated, feel weaker

Menstrual cycle and key fitness metrics

The literature is lacking, and studies are small and low-quality. Given that, most studies and review articles conclude:

- No evidence of differences in lactate threshold or VO_2 max ("fitness") across cycle
- Little evidence for differences in power production across cycle
- No evidence of differences in long-term strength or muscle growth
- Breathing rate higher at given exertion during luteal phase
- Core body temperature and heart rate (resting and ?activity) higher during luteal
- Mixed findings on fatiguability (time to exhaustion) across cycle
- Mixed findings on rate of perceived exertion across cycle
- No evidence of effect on 2k erg time (one article)



VO_2 max testing on an erg

Anyone seen Vo2 testing before? Have you been tested? Vo2 max testing basically measures your maximal oxygen consumption and is a measure of fitness.

1. https://www.frontiersin.org/articles/10.3389/fphys.2021.761760/full (2021, Frontiers in Physiology) (1st bullet)
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7916245/ (2021, Int J Environ Res Public Health) (2nd bullet, 5th bullet)
3. https://www.frontiersin.org/articles/10.3389/fphys.2021.654585/full (2021, Frontiers in Physiology) (2nd bullet)
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9328165/ (2022, Front Psychol) (7th bullet)
5. https://pubmed.ncbi.nlm.nih.gov/22776870/ (2012, Med Sci Sports Exerc.) (7th bullet)
6. https://pubmed.ncbi.nlm.nih.gov/17596777/ (2007, Med Sci Sports Exerc.) (2nd bullet, 4th bullet)
7. https://www.frontiersin.org/articles/10.3389/fphys.2020.00517/full (2020, Frontiers in Physiology) (6th bullet)
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10076834/#:~:text=Findings%20suggest%20that%20strength%2Drelated,affected%20by%20menstrual%20cycle%20phase. (2023, Front. Sports. Act. Living) (3rd bullet)
9. https://www.tandfonline.com/doi/full/10.1080/17461390802308644?scroll=top&needAccess=true (2008, European Journal of Sport Science) (last bullet, 2nd bullet, 5th bullet) – only 10 eumennorheic females!

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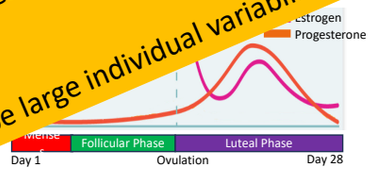
Determining what phase of the cycle someone is in during studies is difficult. Many studies use poor or inaccurate tracking methods.

Studies draw population-level conclusions while there may be large individual variability.



VO_2 max testing on an erg

E.g. cannot assume 28-day period, cannot just track ovulation, luteal phases esp can be affected even if bleeding — may have bleeding but anovulatory cycle or luteal phase defect

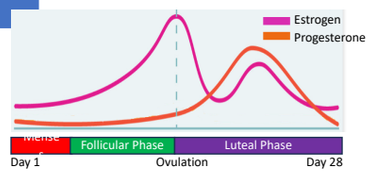
Other review to check out: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8303304/ (2021, Life (Bassel))

Vo2 photo: https://www.canterbury.ac.nz/life/sports-fitness-and-recreation/sport/sport-science-testing/rowing-testing

Menstrual cycle and key recovery metrics

There is even less literature about how recovery varies with the cycle. But limited studies show:

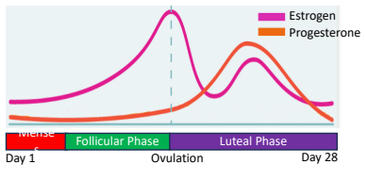
- Sleep quality may be lower during the late luteal and early follicular phases
- Cardiorespiratory recovery may be longer during luteal phase (only one study)
- Ligament laxity and injury risk are higher during follicular phase
- No good evidence that delayed-onset muscle soreness varies with cycle



Sleep quality: https://pubmed.ncbi.nlm.nih.gov/30098748/ (Sleep Med Clin 2019)
Longer for ventilation to recovery during mid-luteal phase?? https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9959793/
Ligament laxity: many studies for ACL, also https://journals.lww.com/acsm-healthfitness/fulltext/2023/09000/the_menstrual_cycle__a_look_back_on_the.4.aspx (2023, ASCM's Health & Fitness Journal)
DOMS: https://www.frontiersin.org/articles/10.3389/fspor.2023.1054542/full

Contraception

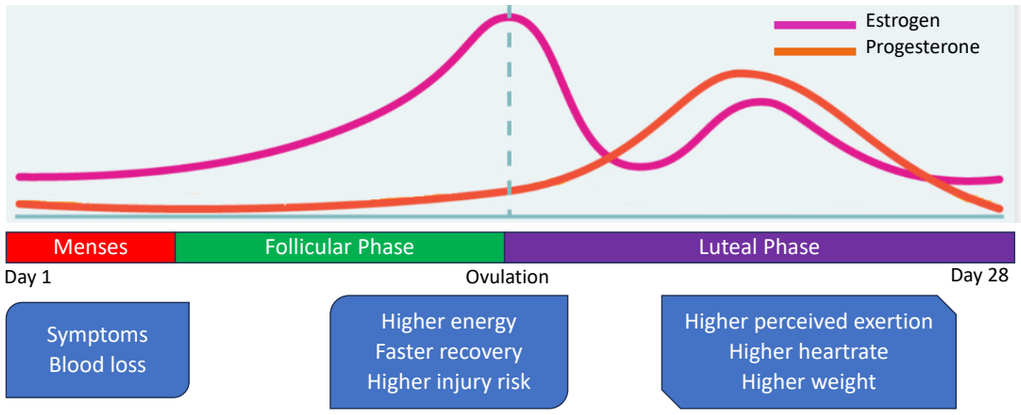
- Contraception methods affect the hormone cycles differently
  - Patterns in heart rate and recovery may be different depending on which form of contraception is used
- There may still be background hormonal fluctuations causing symptoms even if you're on hormonal birth control → track them!
- Still lots of research needs to be done
- Note: while you are on contraception, bleeding is not a true "period"



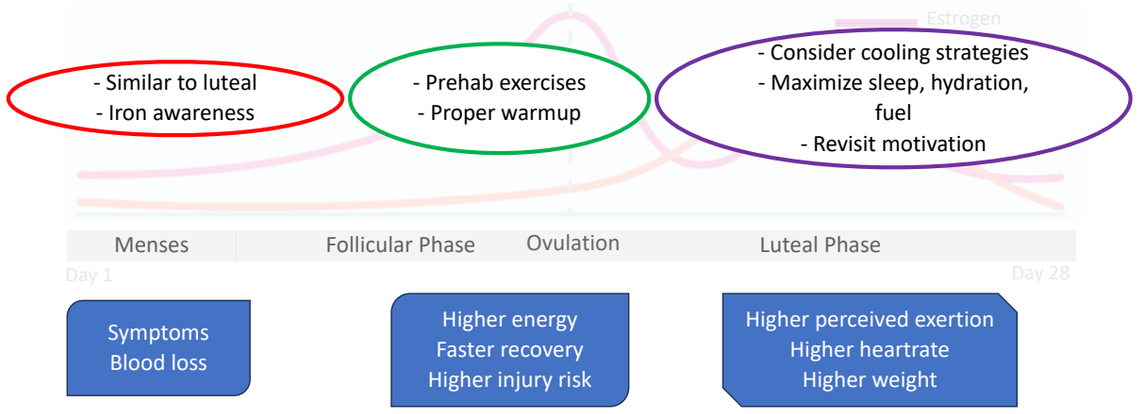
https://bmjopensem.bmj.com/content/7/3/e001047 (BMJ Open Sport and Exercise Med, 2021) – study with Whoop
- Patterns in heart rate and recovery may be different depending on which form of contraception is used
- Progestin-only may have similar responses as normal
- Combined may have lower adaptation/recovery throughout the cycle

Contraception options photo: https://www.center4research.org/guide-selecting-safe-medical-contraception/

Recap: what you may notice



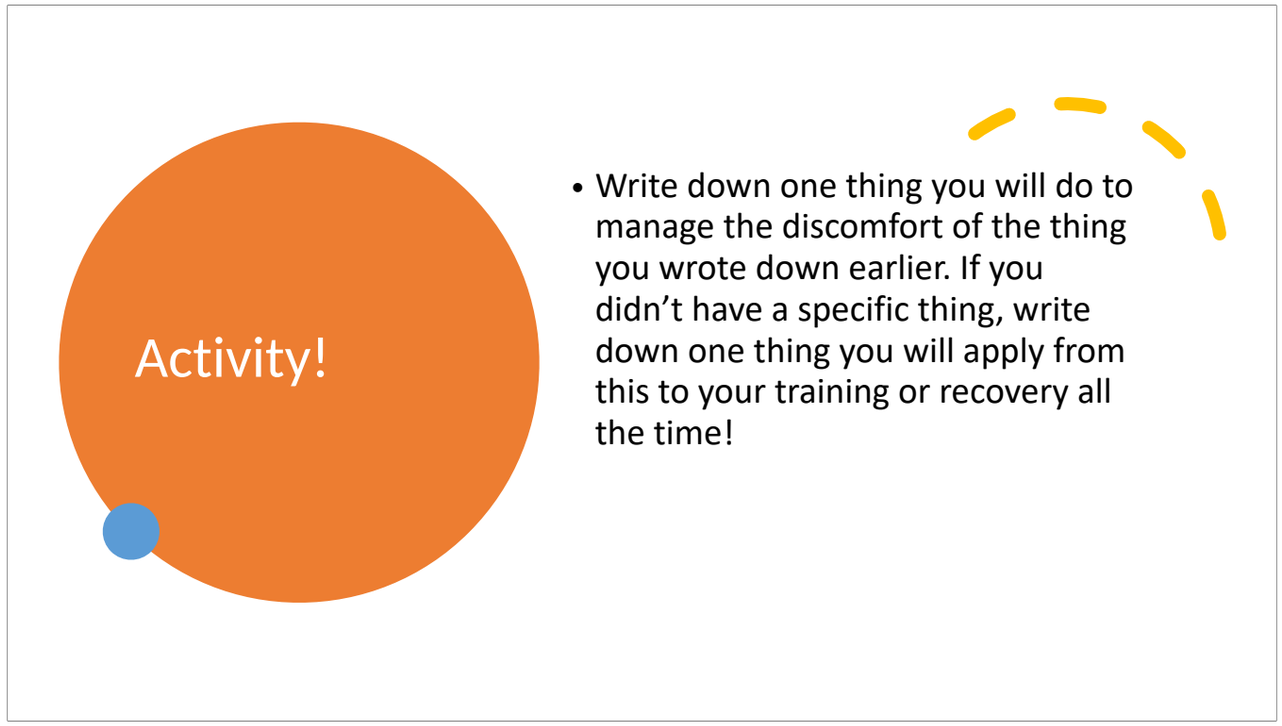
So… what can you control?



1. https://journals.lww.com/acsm-healthfitness/fulltext/2023/09000/the_menstrual_cycle__a_look_back_on_the.4.aspx (2023, ASCM's Health & Fitness Journal)

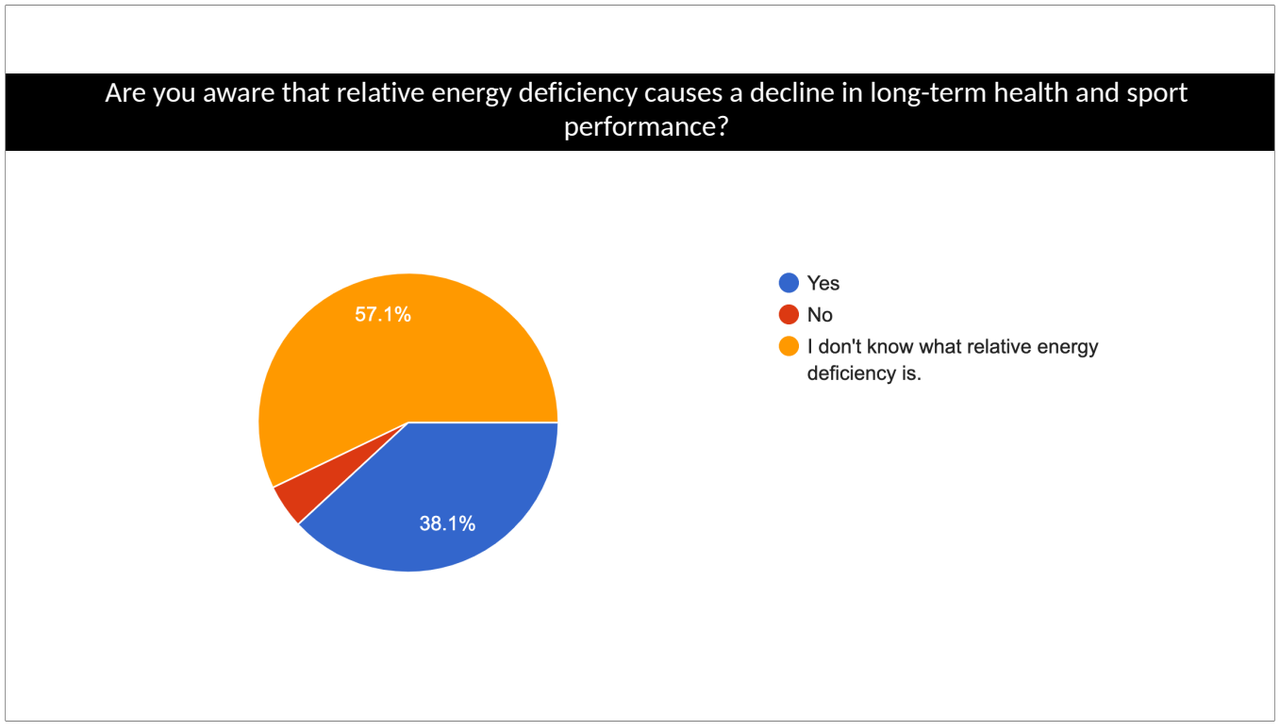
Menses: Can be a time for peak performance while both hormone levels are low. Most important to manage symptoms. Get sleep, eat, hydrate, prehab.
Follicular: Possibly higher energy and quicker recovery. Doesn't mean you can throw all the sleeping and eating out the window though. Body runs really well on carbs.
Luteal: May feel lower energy and have more water weight and higher resting heart rate. Most important to manage symptoms. Get sleep, eat, hydrate, prehab. Most important time to sleep and fuel before and during exercise.

OVERALL: Individuals will vary in their responses throughout the cycle and cycle to cycle. I want to empower you with the knowledge that at the population level research has shown that top performances can happen at any point throughout the cycle. For example, your perceived exertion may be very high during luteal phase but your fitness didn't disappear! This doesn't mean you can't have a PR during those 2 weeks. Try your best to prepare and manage symptoms and work with how you're feeling. You aren't your hormones. You are how you respond and act to give yourself the best chance of a good performance every day.



Activity

For example, if you’re feeling bloated/puffy/heavier, make sure you are eating and drinking enough though that may feel counter-intuitive. If you are feeling foggy, maybe try some caffeine before practice. If you are feeling less power per stroke, try increasing stroke rate to hold splits. If your recovery feels like it’s lagging, make sure you’re sleeping enough and doing Level E workouts easy enough.

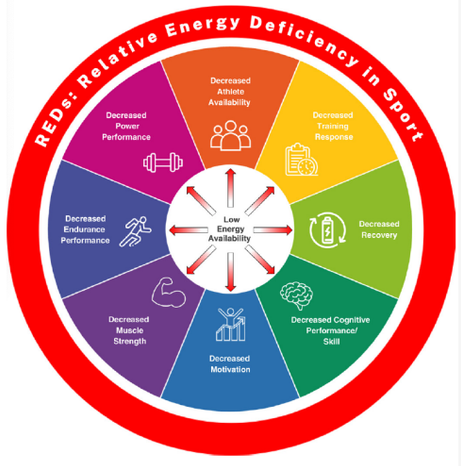

Are you aware that relative energy deficiency causes a decline in long-term health and sport performance?
57.1%
38.1%
Yes
No
I don't know what relative energy deficiency is.

Menstrual irregularity can be a sign of energy deficiency

•**Energy availability** is "the dietary energy left over and available for optimum function of body systems after accounting for the energy expended from exercise."

•**Relative energy deficiency in sport** is "the impaired … functioning that is caused by … exposure to … low energy availability" including impaired menstrual cycle, weak bones, weak heart, worse metabolism, sleep problems, mental health and focus issues.

- Similar symptoms and pathways to overtraining



2023 IOC Consensus Statement on REDs

Menstrual cycle is also a really good marker of your energy availability!!

Has anyone heard of the Female Athlete Triad? (menstrual dysfunction, weak bones, eating disorder)

https://onlinelibrary.wiley.com/doi/abs/10.1111/sms.13030 (2017, Scandinavian J of Med and Sci in Sports) – within-day energy deficiency
Study looking at 25 elite endurance athletes (none with eating disorders): Hours of the day with low energy availability were associated with more time in a catabolic state – in a state where the body was breaking down. Also associated with worse metabolism and higher stress hormone levels.
- why its important to fuel during training as well (especially if you're feeling more fatigued towards the end of workouts)
- fasted training (i.e. training without eating anything beforehand) maybe harms outweigh benefits for females, depending on the situation (work with us if you have to fast for something like Ramadan or Yom Kippur)
- shared symptoms between REDs and overtraining: https://pubmed.ncbi.nlm.nih.gov/34181189/

2023 Journal of the International Society of Sports Nutrition

- Position stand on nutritional concerns for female athletes

- Key points:
  - Female athletes should track their hormone profiles against their training
  - Most important nutritional consideration is getting enough energy
  - Daily protein intake should be 1.4-2.2 g/kg (0.63-1 g/lb) regardless of phase
  - There are hormone influences on carbohydrate and fat metabolism
    - Recommend greater carb intake around and during exercise during luteal phase

I am not a nutritionist.
Activity: calculate how many grams of protein per day you should be getting, at minimum.

1. https://www.tandfonline.com/doi/full/10.1080/15502783.2023.2204066 (2023, J Int Soc Sport Nutr)
2. https://journals.humankinetics.com/view/journals/ijsnem/17/2/article-p189.xml?content=pdf (2007, Int J Sport Nutr and Exercise Met)

Iron

- Symptoms: tired and short of breath at lower efforts, high resting heartrate, poor focus, weak, dizzy

- Get iron panel
  - Other things: Vitamin D, Vitamin B12
  - Especially vegetarian or vegan athletes

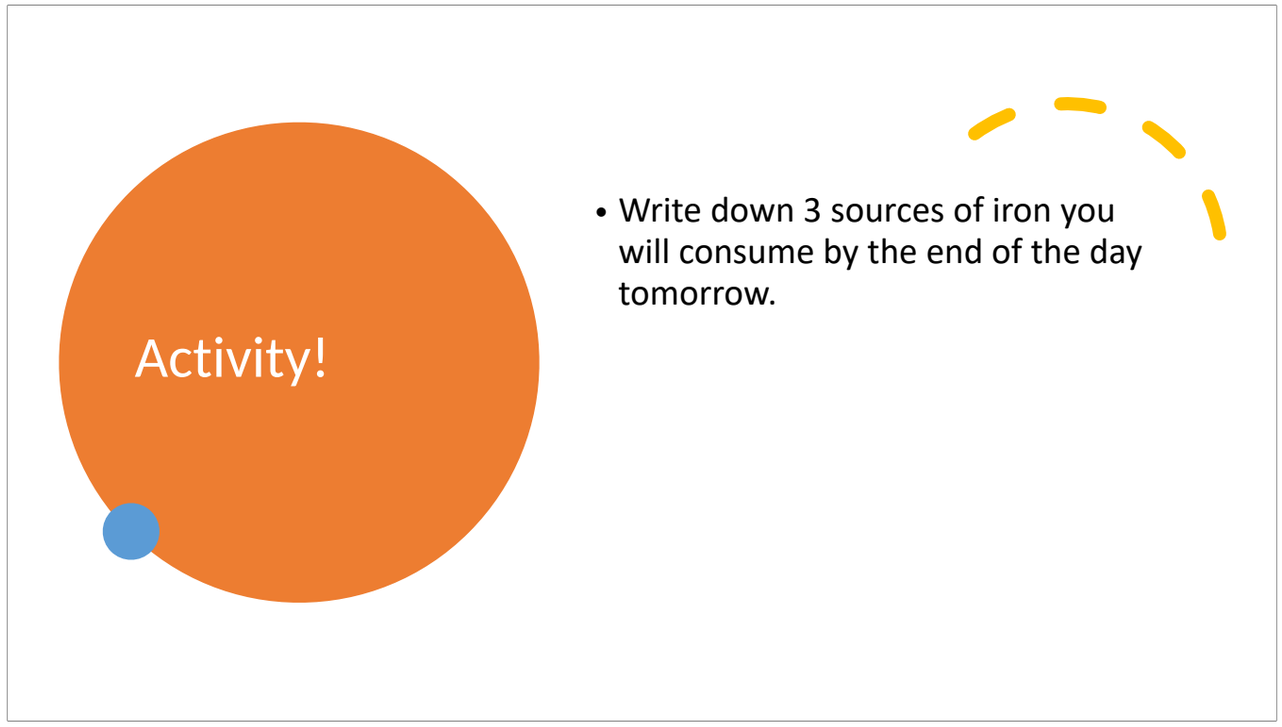
- Iron sources
  - Animal sources: beef, clams, chicken, turkey
  - Plant-based sources: beans, lentils, tofu, potatoes, cashews, dark leafy greens
  - Iron supplements
  - Calcium impairs iron absorption

Up to 52% of female athletes reported to have suboptimal iron status!!!!!!! Anemia is when you have fewer red blood cells. A common cause is iron deficiency, as in you don't have enough iron to support your red blood cells. **You can also have iron deficiency without anemia, which has similar symptoms.** As athletes, recommend you look at your ferritin level. It's debated exactly what level is best for performance, but a lot of studies and experts agree it is quite a bit above the 20-30 ng/mL cutoff that doctors use to tell you you have a normal level (more like 40-50+). Other things affecting red blood cells or iron status: Vitamin D and Vitamin B12, esp if vegetarian or vegan, so potentially consider getting those checked.

Intense training and underfueling are also correlated with iron deficiency.
Don't take iron supplements without a test first – iron overload is toxic
Dietary sources of iron: high (animal sources) vs low (other) bioavailability. Happy to talk about iron supplement choice. Calcium impairs iron absorption, Vit C can improve absorption.

Iron deficiency:

1. https://pubmed.ncbi.nlm.nih.gov/31901316/
2. https://link-springer-com.ucsf.idm.oclc.org/article/10.1007/s00421-019-04157-y
3. https://journals.lww.com/acsm-msse/fulltext/2014/02000/intravenous_iron_supplementation_in_distance.21.aspx
4. Ferritin cutoff: https://www.mdpi.com/2075-1729/13/10/2007
5. Iron foods: https://www.eatright.org/health/essential-nutrients/minerals/iron-deficiency
6. Iron heart: https://www.thedoorknockercompany.co.uk/product/large-heart-shape-cast-iron-trivet/



Activity: write down 3 sources of iron you will aim to consume by the end of the day tomorrow.

New understanding!

Will you track your cycle with your training?	Do you think where you are in the menstrual cycle affects your fitness?	Do you think it affects nutrition?
Do you think it affects heart rate?	Do you think it affects weight?	Does this all vary between individuals?

Yes
Fitness - No
Yes
Yes
Yes
Yes!

Should I be adjusting my training based on menstrual cycle phase?

- Research does not yet support population-level guidelines for adapting training based on the menstrual cycle phase.
- However, you are an individual and should listen to your body.

There just isn't really enough evidence to say yet, which is why it's important for you to track individually. Assuming there is no reason to adapt training, you should try to adapt/control what you can control. (As in earlier slide) For example, if you're feeling bloated/puffy/heavier, make sure you are eating and drinking enough though that may feel counter-intuitive. If you are feeling foggy, maybe try some caffeine before practice. If you are feeling less power per stroke, try increasing stroke rate to hold splits. If your recovery feels like it's lagging, make sure you're sleeping enough, getting enough protein and iron, and doing easy workouts easy enough.

There is some evidence that it could affect recovery, so pay extra attention to how you're recovering and what you're doing to help your recovery (i.e. sleeping, hydrating, eating, etc).

Key takeaways

- People have performed at the highest level at all times of the menstrual cycle.
- Track your cycle along with what you notice in training and recovery.
- Eat enough always! Support your sports performance and your long-term health.

Like what we talked about with breathing exercise last week, acknowledge how you are feeling, exist with it, it does not define you.

Track because menstrual cycle may have individual level effects that we are not seeing yet in the research. Tracking apps: FitrWoman, Flo. You can enter all your symptoms and it gives you recs about things to do or eat (based on their own recommendations), and even better, you can also enter whether you had an easy, moderate, or intense activity day. And there are pretty graphs if you're that sort of person. This will take time. You're not going to figure it out between today and tomorrow. You have to take the time to start tracking now though so that it'll pay off in the spring!
If you are never feeling any symptoms and not bleeding or have irregular cycle, make sure you check with a doc because that is not normal (note: if in first year or two of cycle, normal for the cycle to be a bit irregular)

Check your blood. Talk to doc if worried.

"It's about doing the research, but it's also about how we frame it, talk about it, and empower female athletes through that research."

– Dr. Megan Roche, lead FASTR researcher

Who talks about this stuff?

Give an Instagram follow!
•FASTR (Female Athlete Science and Translational Research) Program at Stanford (@stanfordfastr)
•Female Athlete Program at Boston Children's (@thefemaleathleteprogram)

Learn more about female athlete research:
•Female Athlete Podcast
•Christine Yu "Up To Speed"

Nutrition resources:
•Collegiate and Professional Sports Dietician Association (CPSDA) (sportsrd.org)

•Us! The coaches are here to talk.

Questions?
CRI QUESTIONS
- How should testing be approached in relation to the menstrual cycle? What would you do if it were a championship race
- Can a menstrual cycle affect people to different degrees depending on how "severe" someone's cycle is? yes

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BU QUESTIONS

- Whether it is ok to miss an oyo or practice due to period? There will be a time when you have a tough, high-level race when you're on your period. What would you do then? Practice is a good time to work through these things and figure out how you can manage things (or are stuck – reach out!). Happy to work through these questions with you, also a good reflection exercise to do on your own.
- Whether should go off the combined pill because of potential for reduced adaptation compared to normal cycle? There are lots of reasons to be on a certain type of contraception and training shouldn't necessarily be the deciding factor. There are also tons of ways to optimize your performance before considering switching contraception, like optimizing fuel and sleep and other recovery things. Recommend tracking how you feel to see if you really think your recovery is highly affected.
- If switch off of contraception, what's the transition back to normal cycle like in terms of recovery? It might take a couple months to get the normal cycle back once you switch off contraception, but once you have the normal cycle back the same performance/recovery considerations apply as if you'd never been on contraception at all.