EXERCISE INDUCED NAUSEA AND VOMITING

Mary Boudreau Conover BSNed with Lon Kilgore Ph.D

"An athlete's ability to reach maximal performance is a direct result of physical performance, stress tolerance, and immune function. The gastrointestinal (GI) tract is also part of the system that regulates adaptation and regeneration of the athlete."[1]

For over a decade at CF, hurling has been unofficially viewed as somewhat of a badge of honor with a pet name, photos, and T-shirts to commemorate the event. However, vomiting is at least an abuse to the sensitive esophageal lining highly intolerant of acid baths and possibly, when a frequent event, causing inflammatory damage to that important sphincter separating the stomach from the esophagus.[2] Damage of the lower esophageal sphincter muscle leads to reflux and consistent irritation of the esophagus leads to at least inflammation and at worst esophageal ulcers and cancer.

Additionally, intense exercise causes decreased blood flow (ischemia) to the gastric mucosa[3]–swimmers have known this for as long as I can remember. The result may be nausea, which at some point may progress to vomiting, stomach cramps and diarrhea—more than just impaired digestion. These symptoms can be severely and even critically compounded when hot weather and dehydration are thrown into the mix.[4]

Without sufficient blood supply the GI tract simply can't function as designed, rejects its stomach contents, and in some cases the contents of the intestinal tract (diarrhea). The ischemia achieved by athletes in long endurance events also compromises the intestinal barrier, contributing to and compounding the GI symptoms.[1]

THE INTESTINAL BARRIER

The stomach and intestines are lined with a protective barrier formed by an intricate combination of membranes, junctions, mucus, and immunological factors. Different types of stress can breach this barrier, causing increased permeability of the gut lining and allowing entry of harmful bacterial toxins into the blood stream. This distressing concatenation of events may in turn cause inflammation and systemic complications as well as the nausea, vomiting, bloating, bloody diarrhea, and cramping seen in up to half of all participants in extreme endurance events.[1] CrossFit workouts are not even similar to the running

or biking marathons, however, because of the high intensity, however brief, we may dip slightly into the same ugly GI effects.

DIAL IT BACK

As you will see in a report from Dr. Lon Kilgore, our bodies can adjust to this challenge—the annoying nausea, vomiting, and diarrhea, if we back off intensity when the first symptoms of nausea appear.

Just back off a bit and see if you're OK. Don't push it to meet Pukie; he's not worth it. If symptoms persist, take a break and lie down before it progresses further. Wait until your system recovers, then finish the workout. If vomiting is inevitable, we have all seen that we can and do recover, but be warned and consider the event an insult to your gut and a warning that other hurtful scenarios are going on too—like an imbalance in the testosterone/cortisol ratio.

A SCIENTIFIC EXPERIMENT BY ONE OF OUR OWN

Lon Kilgore Ph.D did a study in his laboratory at Midwestern State University, Department of Kinesiology involving his own performance of 4 consecutive weeks, 5 days per week of multi-modal CrossFit workouts to evaluate the effect on VO2 max. Dr. Kilgore very generously took time to read this article. His response is in the following two emails.

Email #1 From Lon Kilgore Ph.D

" I did a 4 week pilot study of blood oxygen desaturation to 91% or lower via CF training and its relationship to improving VO_2 max .

The first workout out off the blocks was Cindy (used as a bench mark) and within 5 minutes I experienced relatively profound nausea. My strength allowed me to work hugely faster than my oxygen handling systems could and thus---severe vascular shunting away from the viscera and nausea. Five minutes later I was back finishing the workout but at a slower pace for sure.

Two days later Diane (as Rx'd) kicked my butt about 7 minutes in for the same reason, 225 lb. deadlifts and handstand pushups are easy but doing so many so rapidly caused a repeat session of nausea and a dismally slow time.

I desaturated to 89-91% throughout those two sessions. What I think is happening is that by the time you are experiencing nausea, you have driven your O_2 saturation too low (worked too hard) causing profound shunting away from the GI tract.

You need to push just shy of that point, to the edge of nausea, to get the maximal results, but pushing on into full on nausea and Pukie-town slows down the work

rate and makes you miss the target workload - and thereby the fitness gain possible from that workout.

It is inevitable that people will miss the mark and get nausea and ralph their guts out every now and then. And that should be a learning experience, they should learn about the sensations and the signals their body is sending them so they can push the envelope with more accuracy and avoid spending valuable training time rolling on the floor nauseas or praying to the porcelain god.

After I figured it out (took two sessions of nausea), I knew when to start taking breaks rather than just brute forcing it. And it paid off, 33.4% increase in VO_2max in four weeks."

Email #2 from Lon Kilgore Ph.D

Daily log of nausea

Days 1 and 3: Cindy and Diane. *Huge and nasty nausea on days 1 and 3. The kind you lay on the bathroom floor with. The kind reminiscent of a severe college all night bender.*

Day 2: *Not bad on day 2 (easier workout)*

Day 4: *Day 4 not bad either.*

Day 5: *A running repeat day and kettlebell swings I believe and there was a little nausea controlled by the trainer (Justin) telling me to back off.*
After that it never reappeared.

Note: The "Justin" in Lon's email is Justin Lascek, head of CrossFit Wichita Falls

Hydration. I can't close without at least a word on hydration and its effect on digestion. An elegant study out of The Netherlands has found that dehydration causes a delay in the emptying of the stomach. This in turn may result in exercise-induced nausea.[5] Arrive for your workout hydrated, but not over-hydrated—ever.

ACKNOWLEDGEMENTS

Lon Kilgore Ph.D, deserves everyone's thanks for sharing his very personal experience in a respected scientific study involving CrossFit WODs and VO_2 max. His observations on nausea were an unexpected side bar to his experiment with VO_2 max. Thank you, Lon.

Big credit is due **Ronnie Boose** at CrossFit North Santa Cruz for his inspiration with a photo and an excellent post on their web site (June 9). Thanks Ronnie, you really launched this one—been waiting years for an opening!

Denver also deserves credit and acknowledgement for taking me one step further. Thank you, Denver!

REFERENCES

[1] Berg A, Müller HM, Rathmann S, Deibert P: **The gastrointestinal system--an essential target organ of the athlete's health and physical performance**.*Exerc Immunol Rev*. 1999;5:78-95. Abteilung Prävention, Rehabilitation und Sportmedizin, Medizinische Universitätsklinik, Freiburg, Germany.

[2] Kawamura O, et al: **Endoscopic ultrasonographic abnormalities and lower esophageal sphincter function in reflux esophagitis**. Digestive diseases and sciences, 1995, vol. 40, n°3, pp. 598-605 (18 ref.) Gunma univ. school medicine, first dep. internal medicine, Maebashi, Gunma 371, JAPON

[3] Steege RW, Kolkman JJ, Huisman AB, Geelkerken RH: **Gastrointestinal ischaemia during physical exertion as a cause of gastrointestinal symptoms.** *Ned Tijdschr Geneeskd*. 2008 Aug 16;152(33):1805-8.

[4] Lambert GP: **Stress-induced gastrointestinal barrier dysfunction and its inflammatory effects**. *J Anim Sci*. 2009 Apr;87(14 Suppl):E101-8. Epub 2008 Sep 12. Department of Exercise Science, Creighton University, Omaha, NE 68178, USA. plambert@creighton.edu

[5] van Nieuwenhoven MA, Vriens BE, Brummer RJ, Brouns F: **Effect of dehydration on gastrointestinal function at rest and during exercise in humans.** *Eur J Appl Physiol*. 2000 Dec;83(6):578-84. Department of Gastroenterology, University Hospital Maastricht, The Netherlands.

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