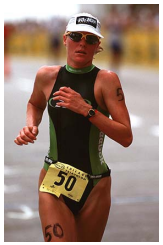
Darmprobleme: Welche Rolle spielen FODMAPS, Proteinunverträglichkeit und Bewegung bei Reizdarmsyndrom bei Athleten?“



Fred Brouns
Maastricht University, Netherlands

Order of the day

Is the gut an athletic organ?*

1. Exercise and movement effects
2. Protein- gluten effects
3. FODMaP/fiber effects

*Brouns F & Beckers E. Sports Med. 1993 Apr;15(4):242-57

No Guts No Glory

- Whom of you did never vomit?
- Whom of you did never have a watery poop?

So …., you know what is it about?

Be ready, Shit happens…

Case 1

- Undesired external circumstances that are difficult to avoid but can make you sick….

Case 1: Sometimes in swimming: often swallowing salt, dirty water

Diana Nyad completes 110-mile swim from Cuba to Florida despite 'vomiting constantly'

The 64-year-old Nyad wore a special mask to fend off jellyfish. The mask was successful, but nauseated her. 'I was sick as a dog,' she said.

Case 2

High intensity exercise of long duration, leading to:

- Dehydration,
- Increased body temperature (up to >40 Celsius)
- Exertion

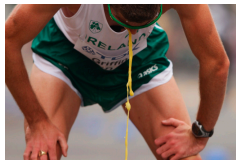
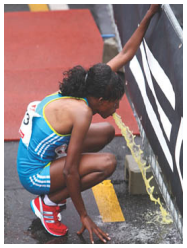
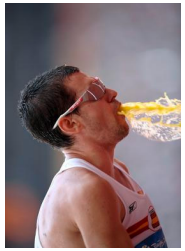
can create vomiting and diarrhea, sometimes bloody

Case 2, beyond limits

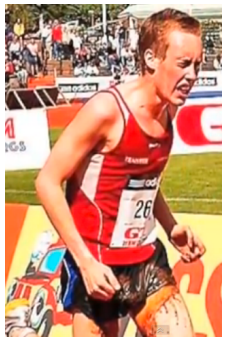
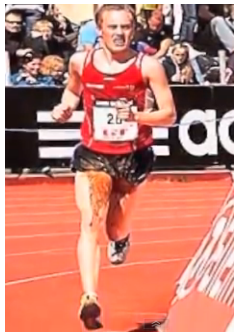
Case 3- 6

- Intensive exercise with continuous vertical movements/ shaking of the gastrointestinal tract will lead to more problems than “gliding sports” with no shaking, eg. cycling/

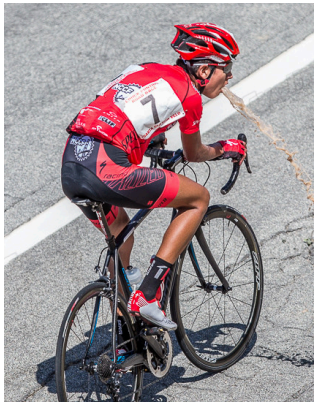
Case 3; More in runners due to"gut shaking"


Case 4: when the shit hits the fan… sometimes lower gut "failure"..

Case 5: Least in "gliding sports"




Gastrointestinal disorders during exercise:

> 40% of participants in intensive endurance events

- more at > 60%VO_2max
- Running > cycling
- Women > men
- Adults > youngsters
- Dehydrated > Hydrated
- Heat > Cold

Complex etiology !

Case 6

- Environmental conditions impacting on fluid needs may play a significant role on stress and GI effects

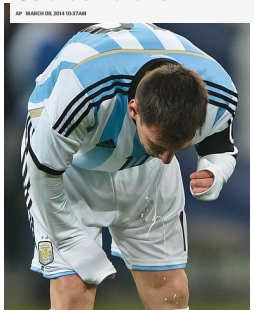
Case 6: Swiss alpine marathon Davos, valley 30º +, top - 2º Celcius

Case 7

- Team sports: an exception but it may happen..

Case 7 : Sometimes in team sports

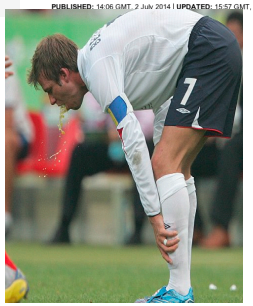
Lionel Messi vomiting a concern for Barcelona coach Gerardo Martino

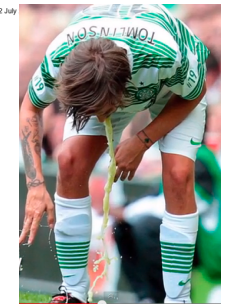


Jan Vertonghen follows in the footsteps of David Beckham, Zinedine Zidane and Lionel Messi... by vomiting on the pitch

By JOHN DRAYTON FOR MAILONLINE

PUBLISHED: 14:06 GMT, 2 July 2014 | UPDATED: 15:57 GMT, 2 July





Often due to “too concentrated’ sports drinks

Case 8

- Heat exhaustion is a major contributor to GI stress, even if the overall exercise intensity is relatively moderate, but heat exposure is very long: eg. > 5 hrs of tennis
- ➔GI-Distress + frequent drinking ➔ reflux / vomiting

Case 8: sometimes in Tennis in the Heat

Case 9

Worst scenario: severe dehydration in the heat….

Case 9: "lost" in dehydration, hyperthermia, intestinal cramps and desorientation

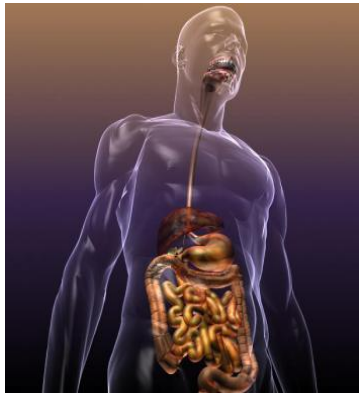
Would they do it better better without guts….?

Case 10

- High pressure on the stomach will push contents either into the gut or back to the mouth, the latter more likely due to a lower sphincter pressure in the oesophagus, compared to gastric sphincter

Case 10: high stomach pressure

Symptomatology classification



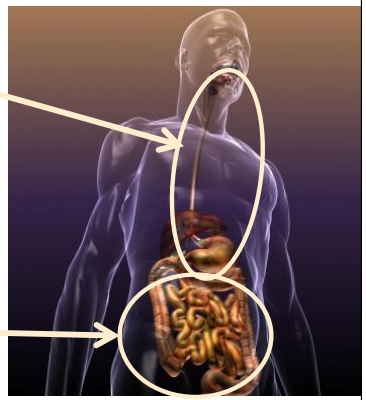
Classification:

'Upper gastrointestinal" disorders:

- **reflux**
- **gastric cramps**
- **vomiting**

'Lower gasrointestinal" disorders:

- **bloating**
- **urge to defecate**
- **intestinal cramp**
- **diarrhea (sometimes bloody)**



Effect of exercise on motility and transit

- Mental/physical stress
- Hormone secretion
- Nervous activity

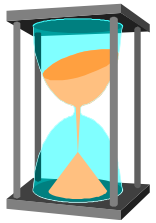
→ Motility, secretion , absorption

- Reduction in GI tone → Delayed Gastric emptying , reflux, vomiting

- Reduction in small bowel motility
- Reduction in small bowel tran
- Increased secretion
- Enhanced large bowel transit
- Mechanical influences

→ Loose stools, urge to defecate

Intestinal transit



• Stomach- small intestine	4 – 8	hours
• COLON	24 – 72	hours
• **Whole gut transit**	**28 – 80**	**hours**

Majority of studies show that intensive exercise:

- reduces upper GI motility/propulsion
- delays small bowel transit
- BUT reduces overall GI transit time => enhances fecal delivery

Whole gut transit is affected by many variables

Factors impacting on whole gut mean transit time (MTT)

- Eating➔ food intake volome/weight
- Diet composition, fibers quantity and quality
- Absorption/secretion
- Bacterial metabolism
- Colonic anatomy
- Posture
- Sleep
- Stress: mental/physical
- Travelling: changes of climate, food, drink
- Antibiotics use
- ….other

Exercise induces reflux

Exercise can decrease Lower Esophageal Sphincter (LES) pressure.

- High intensity exercise > low intensity.
- Running > cycling.

Gastric emptying

- **Training status** — no effect
- **Emotion/mental stress** — delayed GE
- **Intensity** :
  - ≤ 70% VO_2max — no effect
  - ≥ 70% VO_2max — delayed GE
- **Carbohydrate content**
- ≤ 50g glucose, ≤ 70g di-, oligo-, polysacch ➔ no - minor effects
- > 50g glucose, > 70g di-, oligo-, polysacch➔ delayed GE, reflux, vomiting

Hemodynamics during exercise

- Plasma norepinephrine ↑
- Heart frequency ↑
- Oxygen consumption ↑
- Mixed venous oxygen content ↓
- Blood preference for muscle and skin

Mesenteric artery blood flow (MAB)

	Exercise Intensity	MAB
Quamar, Read 1987	60-80% Vo2 max	43% reduction
Khel et al 1986	70% Vo2 max	80% reduction

→ Hypovolemia- hypoperfusion effects

HYPOVOLEMIA- GUT EFFECTS

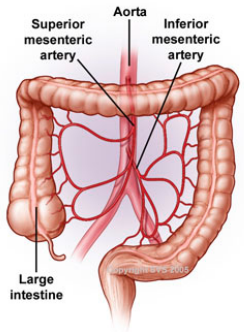
Blood flow ↓↓

Oxygen / energy delivery ↓↓

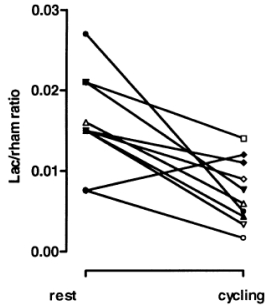
- HCl neutralization reduction
- Increased free radical formation
- Sodium/potassium pumping failure
- Gastrointestinal hormone responses

- Increased fluid secretion ➔**diarrhea**
- Leaky gut symptoms
- Lesions
- Necrosis

→ Blood loss

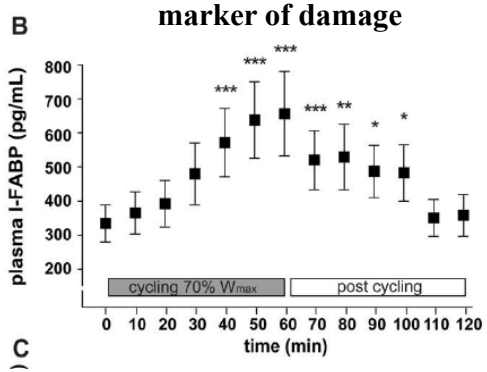


Intense cycling induces increased gut permeability



Van Nieuwenhoven, Brouns. Neurogastroenterol. Mot. (1999) 11, 431- 439

Intestinal Fatty Acid binding protein release as marker of damage



Plasma IFABP levels reflect the development of intestinal epithelial cell damage during cycling and post cycling in healthy volunteers (n = 20)

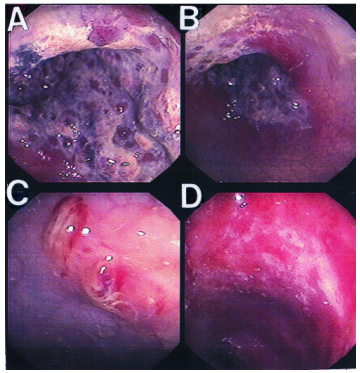
Van Wijck et al . 2011 PLOS 1 open access: DOI: 10.1371/journal.pone.0022366

Ischemic colitis in marathon runners: A case-based review

- Reported incidence of occult blood: ranges from 8–85%!
- 16% of runners in an interview study reported bloody diarrhea on at least one occasion after a race
- Ischemia can occur in the entire gastrointestinal tract.
- Endoscopy after a race has found a high rate of gastritis
- True incidence of ischemic colitis in endurance athletes is not known.

Leon D. Sanchez, The Journal of Emergency Medicine, Volume 30, Issue 3, April 2006, Pages 321–326

Reversible ischemic colitis in a high endurance athlete



Endoscopic findings of ischemic colitis. Sigmoid colon with segmental narrowing, marked hyperemia, submucosal hemorrhage, nodularity, and fibrinopurulent exudate (*A, B*). *Focal inflammatory changes in rectum (C). Region of moderately severe segmental colitis in rectosigmoid junction (D).*

American Journal of Gastroenterology (1998) ***93, 2231–2234; doi:10.1111/j.1572-0241.1998.00621.x***

Diet, exercise and gut health

- Significant diet change
- Role of FODMaPs
- Effects of gluten and wheat

Some endurance athletes periodically change diet habits dramatically……. with the risk of Gastrointestinal Problems

- Periods with low fat/ high glycemic CHO
- Periods with High fat / low CHO – low fiber intake
- Periods with high/low fiber intake

Diet composition affects volume and transit

Dietary fiber
↓
Intestinal bulk
↓
Colonic filling
↓
Bacterial growth
↓
Colonic metabolism
↓
Secretion absorption
↓
Feacal mass
↓
Transit time

The good, the bad and the ugly in our gut

Gas in the gut during exercise is no fun !

What symptoms are associated with ingestion of fiber?

- **Tolerance of rapidly fermentable fibers (FODMaPs)**
  - Bloating
  - Flatulence
  - Laxation

↓ Athletes “fibre paradox”

Use regular fiber rich meals BUT avoid high fiber of FODMaPs during the last 24 hrs prior to exhausting RUNNING endurance exercise!

FODMAP: Fermentable oligosaccharides, disaccharides, monosaccharides and polyols

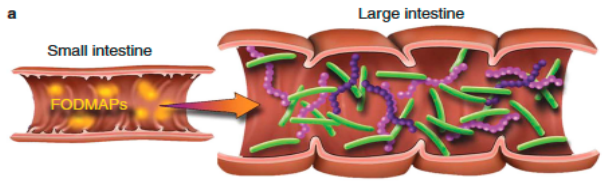
Table 1. FODMAP carbohydrates and their richest food sources.

FODMAP	Richest food sources
Fructo-oligosaccharides (fructans)	Wheat, rye, onions, garlic, artichokes
Galacto-oligosaccharides (GOS)	Legumes
Lactose	Milk
Fructose	Honey, apples, pears, watermelon, mango
Sorbitol	Apples, pears, stone fruits, sugar-free mints/gums
Mannitol	Mushrooms, cauliflower, sugar-free mints/gums

Small non-absorbable molecules that rapidly ferment induce osmotic laxation and rapid gas production ➔ bloating, loose stools, cramps

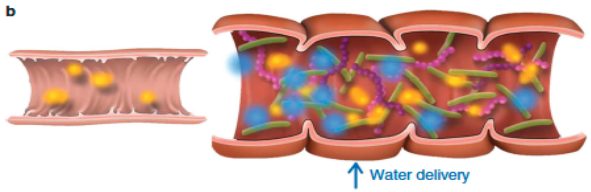
Ther Adv Gastroenterol (2012) 5(4) 261–268 DOI: 10.1177/ 1756283X11436241

FODMaPs rapid fermentation effects



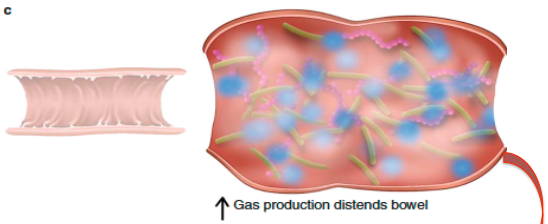
Shepherd , et al. Am J Gastroenterol 2013; 108:707–717; doi: 10.1038/ajg.2013.96

FODMaPs rapid fermentation effects



Shepherd , et al. Am J Gastroenterol 2013; 108:707–717; doi: 10.1038/ajg.2013.96

FODMaPs rapid fermentation effects



Gastrointestinal distress
Restlessness
Poor sleep
➔Fatigue
➔During exercise urge to defecate, cramps, ..

IBS patients say they feel better when avoiding FODMAPS

- **BUT, how many persons have IBS?**
- **In fact, all fermentable oligosaccharides are prebiotics that selectively stimulate the growth of friendly bacteria, improve mucus formation and gut barrier function**
- **Should all of you avoid FODMaPs?.....stop eating bread…?**

The Dietary Fibers–FODMAPs Controversy

F. Brouns,[1] N. Delzenne,[2] and G. Gibson[3]

Holland

Belgium

England

Cereal Foods World issue May/June 2017, Vol 62, nr 3, p 98-103

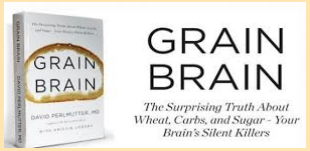
FODMaPs: *What is known:*

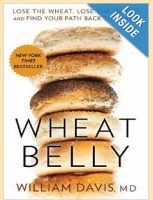
- Dietary fibers and prebiotics are important for improving gut health and increased consumption is generally recommended
- Avoidance of FODMaPs is being recommended for persons suffering from irritable bowel syndrome, to alleviate abdominal distress due to intestinal gas production and fluid shifts, leading to bloating
- Small osmotic effects and gas formation are normal processes in the healthy gut, and are not disease symptoms.
- Cereals contain a small quantity of rapidly fermentable carbohydrates

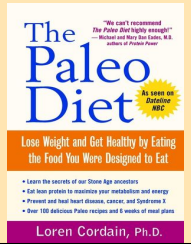
FODMaPs: *What is new/needs attention:*

- Avoidance of fermentable dietary fibers may impair favorable gut flora metabolism, gut function and health
- Skipping grains from the diet for reasons of FODMaPs means also skipping of a whole range of other components known to be beneficial
- Increasingly FODMaPs free foods are being marketed and promoted to the general public. A hype seems developing.
- FODMaPs avoidance, to relief intestinal discomfort, is only recommended on a personal basis and under medical/dietetic control.

Wheat consumption causes addiction to food, obesity and auto-immune diseases!

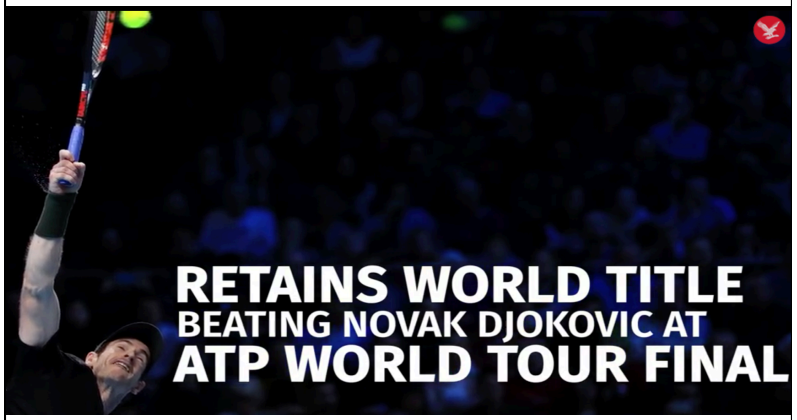






Djokovic GF is Great!

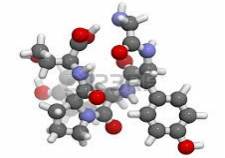
Murray GF killed me!



Do consumers know what gluten is…….?

Does she know?

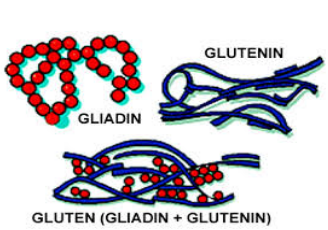
Gluten exorphins (opioids) are n3+ peptides that are not absorbed



Gly-Tyr-Tyr-Pro-Thr-Ser
Gly-Tyr-Tyr-Pro-Thr
gluten exorphin A5
Gly-Tyr-Tyr-Pro
gluten exorphin A4
Arg-Tyr-Tyr-Pro
Ser-Tyr-Tyr-Pro
Trp-Tyr-Tyr-Pro
Tyr-Tyr-Pro-Thr
Tyr-Tyr-Pro
Gly-Tyr-Tyr

Tyr-Gly-Gly-Trp-Leu
gluten exorphin B5
Tyr-Gly-Gly-Trp
gluten exorphin B4
Tyr-Gly-Gly-Phe-Leu
[Leu]enkephalin

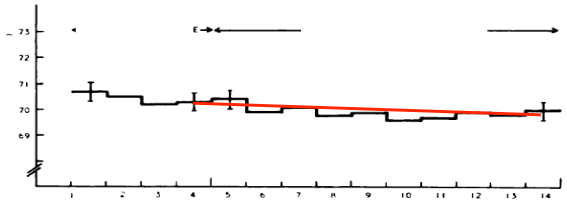
What is gluten?



A protein that after addition of water and kneeding forms an elastic network in the dough.
In entraps gases that are formed during the yeast/sourdough fermentation ➔ balloon effect ➔ rising of the dough

A 50 days wheat gluten ONLY diet did NOT raise BW

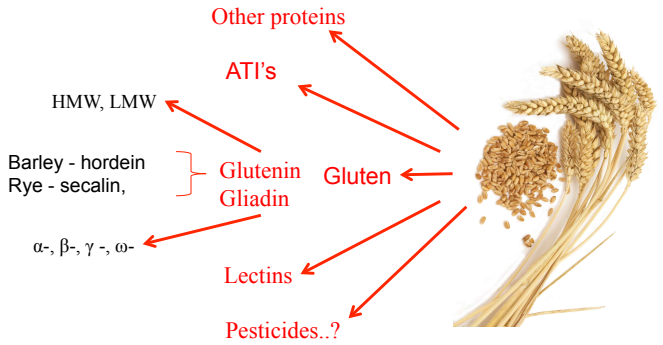
- Control phase, 20 days subjects received a normal-type diet ➔ 12.2g N/day, 45% from animal sources: milk, eggs, and meat
- Experimental phase 50 days➔11.8g N/day, of which, 90-95% was derived from commercial wheat



Specific fragments of gluten protein are not digested by human intestinal enzymes.
In some persons, having a specific genetic background, this can lead to celiac disease, a gut wall disease

Sapone, Fasano BMC Med. 2012; 10: 13.Published online 2012 February 7. doi: 10.1186/1741-7015-10-13

Suggested wheat sick makers



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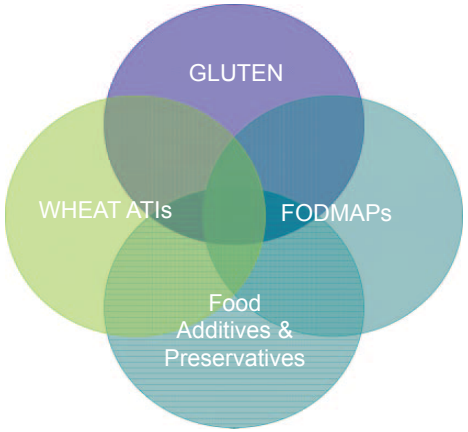
Triggers of NCGS



Content of FODMaPS in wheat products is low

- Fructans in bread ➔ 0.1- 0.5g/ 2 slices of bread
- Fructans breakfast cereals ➔ 1.0 g/cup (35-50g)
- Fructans in pasta ➔ 0.5g /portion-cup (148g)

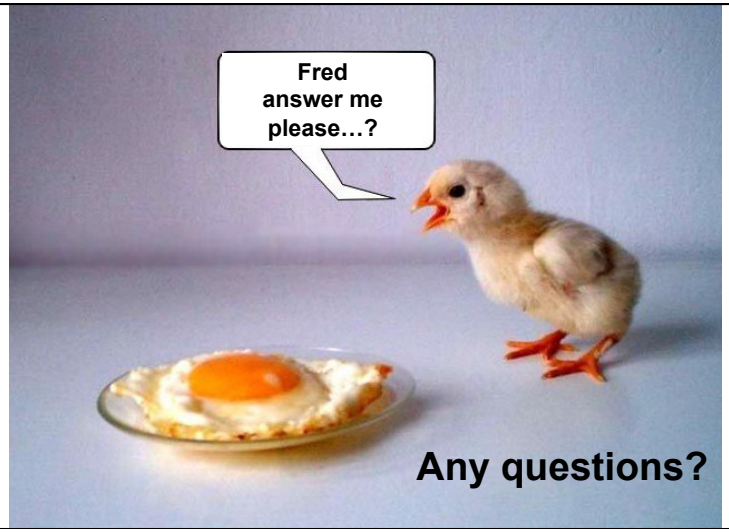
Wheat protein rivals whey for muscle growth, study suggests

By Will Chu, 05-Sep-2016 1 comment
Last updated on 05-Sep-2016 at 16:20 GMT

Gluten is a good source of Leucine

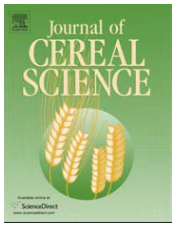
Let's cook some final considerations

- Gastrointesitanl problems occur in > 40% of endurance athletes
- Triggering factors are type of exercise, intensity and duration ➔ dehydration, hypertonic drinks, diet changes
- Gluten is not a cause of GI problems in athletes unless celiac disease is present (1% population)
- Some people may be wheat sensitive without celiac disease (4-6%?)
- FODMaPs are good prebiotics but may cause diatress in IBS



Does wheat make us fat and sick?
Brouns F. et al, 2014
DOI: 10.1016/j.jcs.2013.06.002

Open Access



Health effects of wheat lectins: A review
Brouns F, Buul V
doi.org/10.1016/j.jcs.2014.01.010

Is modern wheat bad for health?
Shewry et al. 2016
DOI: 10.1038/NPLANTS.2016.97

Do "ancient" wheat species differ from modern bread wheat
Shewry and Hey. 2015
doi.org/10.1016/j.jcs.2015.07.014

Athletic gut's

- Sports Med. 1990 Mar;9(3):159-72. Moses FM. "**The effect of exercise on the gastrointestinal tract".**
- Sports Med. 1993 Apr;15(4):242-57. Brouns F & Beckers E. "**Is the gut an athletic organ?"**
- Neurogastroenterol. Mot. (1999) 11, 431- 439 Van Nieuwenhoven , Brouns & Brummer **. Effect of physical exercise on parameters of gastrointestinal function**

- Curr Sports Med Rep. 2006 May;5(3):161-4. Murray R.”**Training the gut for competition”.**
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