

Medicine & Science in Ultra-Endurance Sports

GASTROINTESTINAL DISTRESS IN ULTRAMARATHON RUNNERS

Kristin J. Stuempfle, PhD, FACSM, ATC

Gettysburg College

June 24, 2014



in the city
america

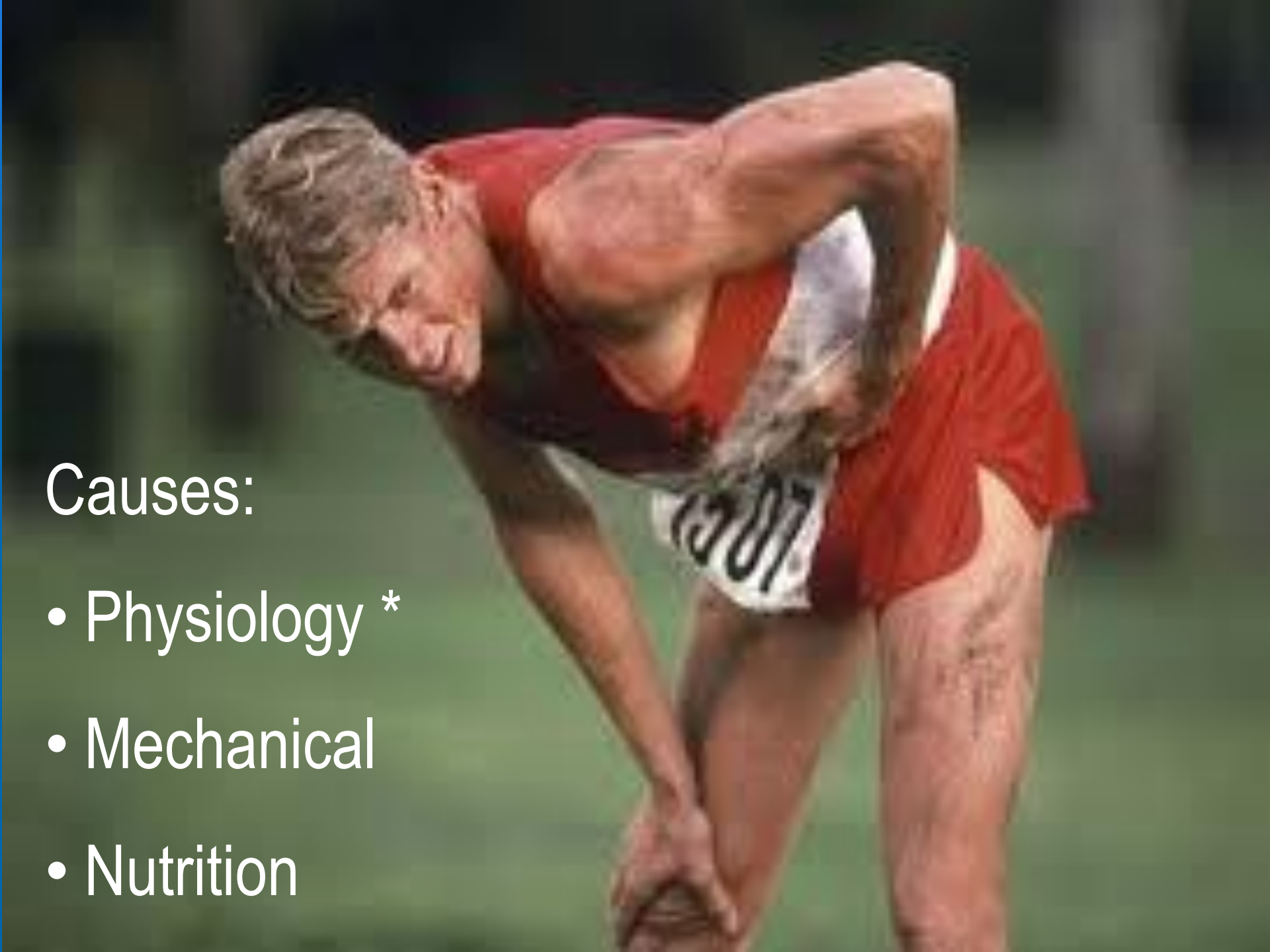


“The hardest part about an ultrarun isn’t the running. It’s getting my stomach to cooperate.”

-Ann Trason, 14-time women’s winner of WSER.

GI DISTRESS

- 37- 60% of runners in 67-161 km races
- 161 km races:
 - Non-finishers: 1st reason for dropping out
 - Finishers: 2nd issue impacting performance



Causes:

- Physiology *
- Mechanical
- Nutrition

25 L/min

Cardiac output = 25 L/min

Heavy Exercise

100%

3-5%

4-5%

2-4%

0.5-1%

3-4%

80-85%



Rest

100%

20-25%

4-5%

20%

3-5%

15%

4-5%

15-20%

5 L/min

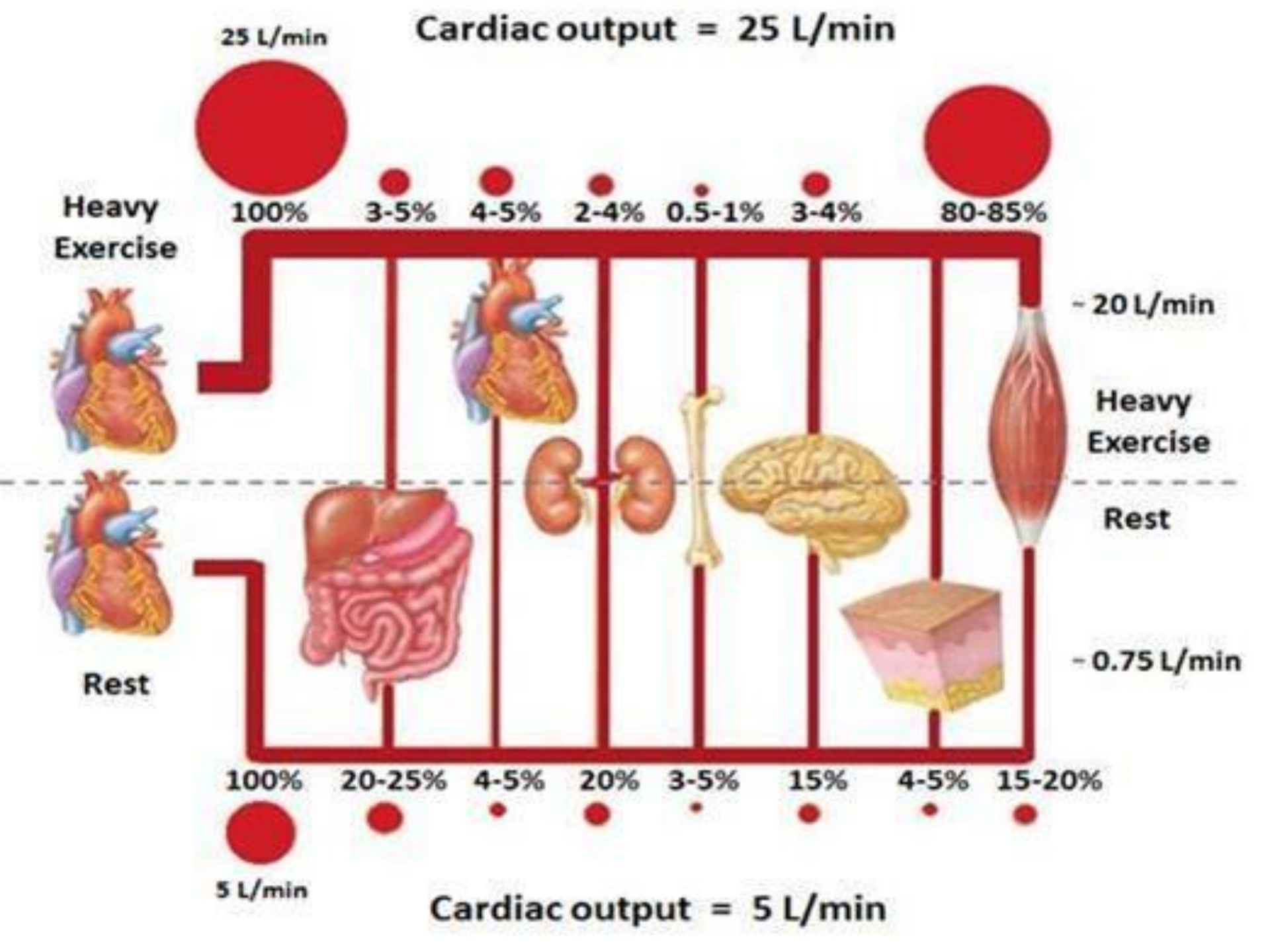
Cardiac output = 5 L/min

~ 20 L/min

Heavy Exercise

Rest

~ 0.75 L/min

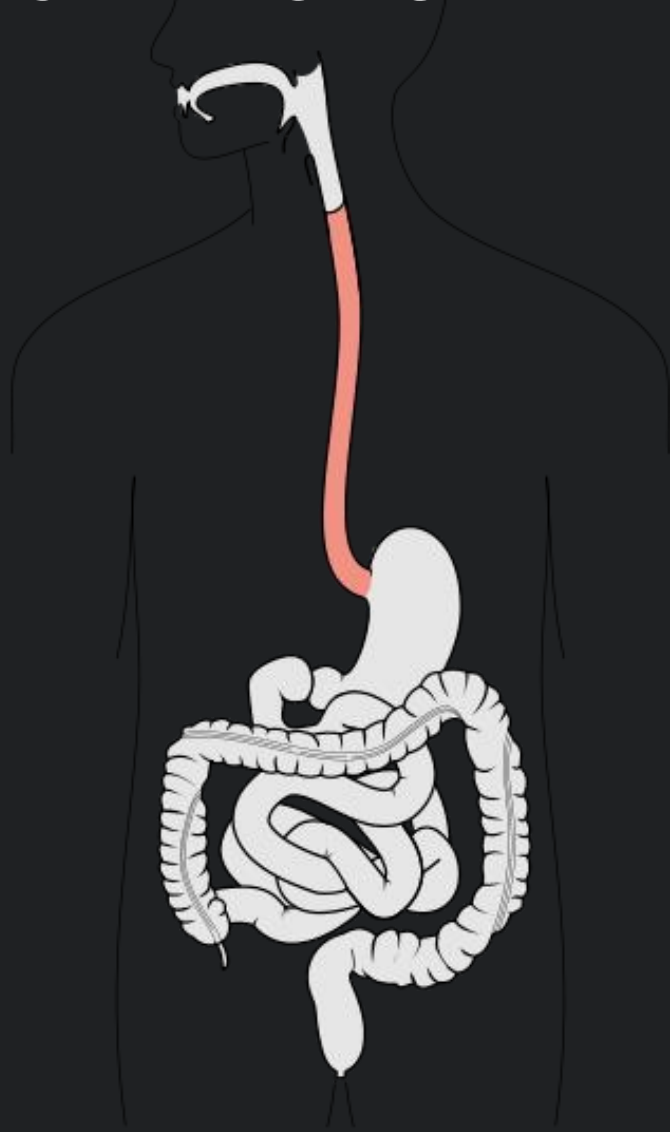


↓ GI BLOOD FLOW CONSEQUENCES



- Motility changes
- Absorption changes
- Gut permeability changes

CHANGES IN MOTILITY: ESOPHAGUS



- ↓ peristalsis
- ↓ LES sphincter tone

GI Symptom:

- Reflux/heartburn

CHANGES IN MOTILITY: STOMACH



Gastric Emptying:

- Moderate exercise: ↔
- Intense exercise: ↓
- Dehydration: ↓

GI Symptoms:

- Stomach bloating
- Stomach cramps
- Nausea
- Vomiting

↓ GI BLOOD FLOW CONSEQUENCES



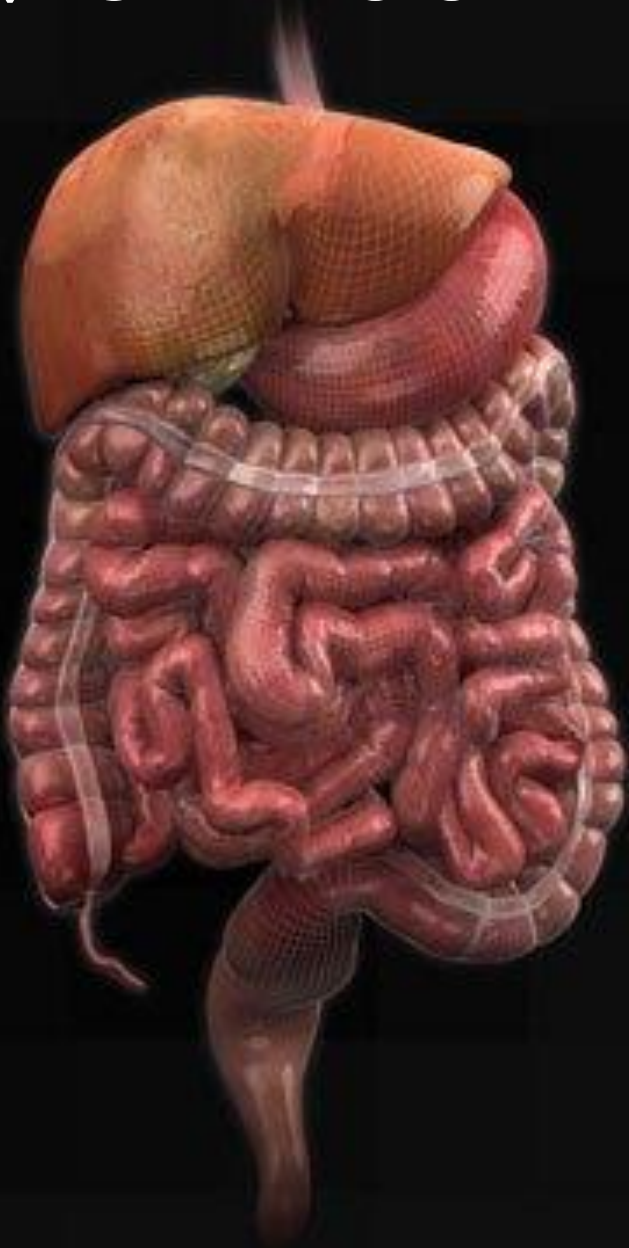
- Motility changes
- Absorption changes
- Gut permeability changes

ABSORPTION CHANGES CARBOHYDRATE AND WATER



- Moderate intensity: \leftrightarrow
- < 2 hours: \leftrightarrow
- \uparrow intensity: \downarrow absorption?
- \uparrow duration: \downarrow absorption?

↓ GI BLOOD FLOW CONSEQUENCES



- Motility changes
- Absorption changes
- Gut permeability changes

GUT PERMEABILITY CHANGES

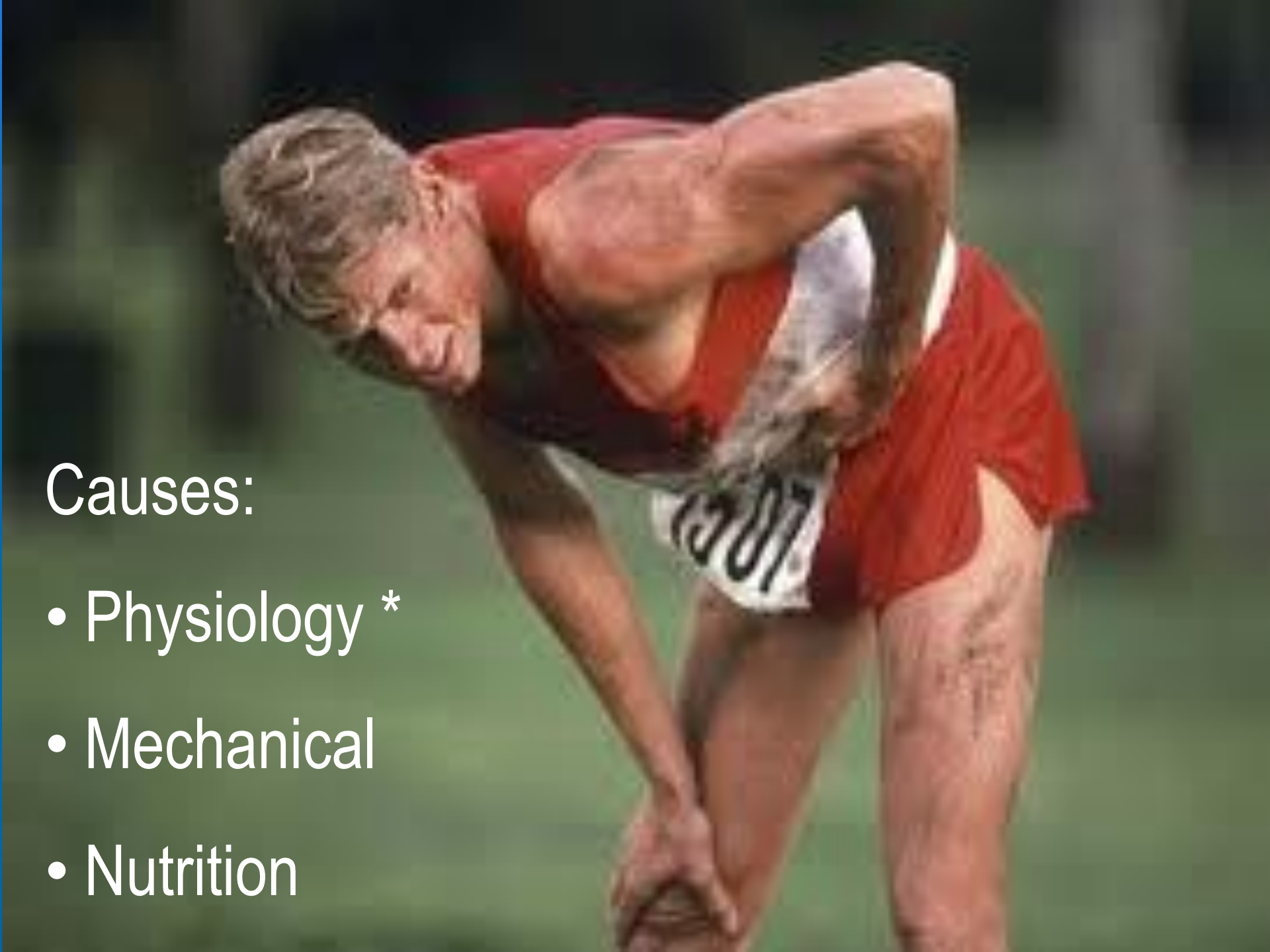


- ↓ GI blood flow may ↑ intestinal permeability and bacterial translocation
- May be linked to GI symptoms
- More research needed!

↓ GI BLOOD FLOW



- Consequences:
 - Motility changes
 - Absorption changes
 - Gut permeability changes
- Exacerbated by:
 - ↑ exercise intensity or duration
 - ↑ environmental temperature
 - Dehydration



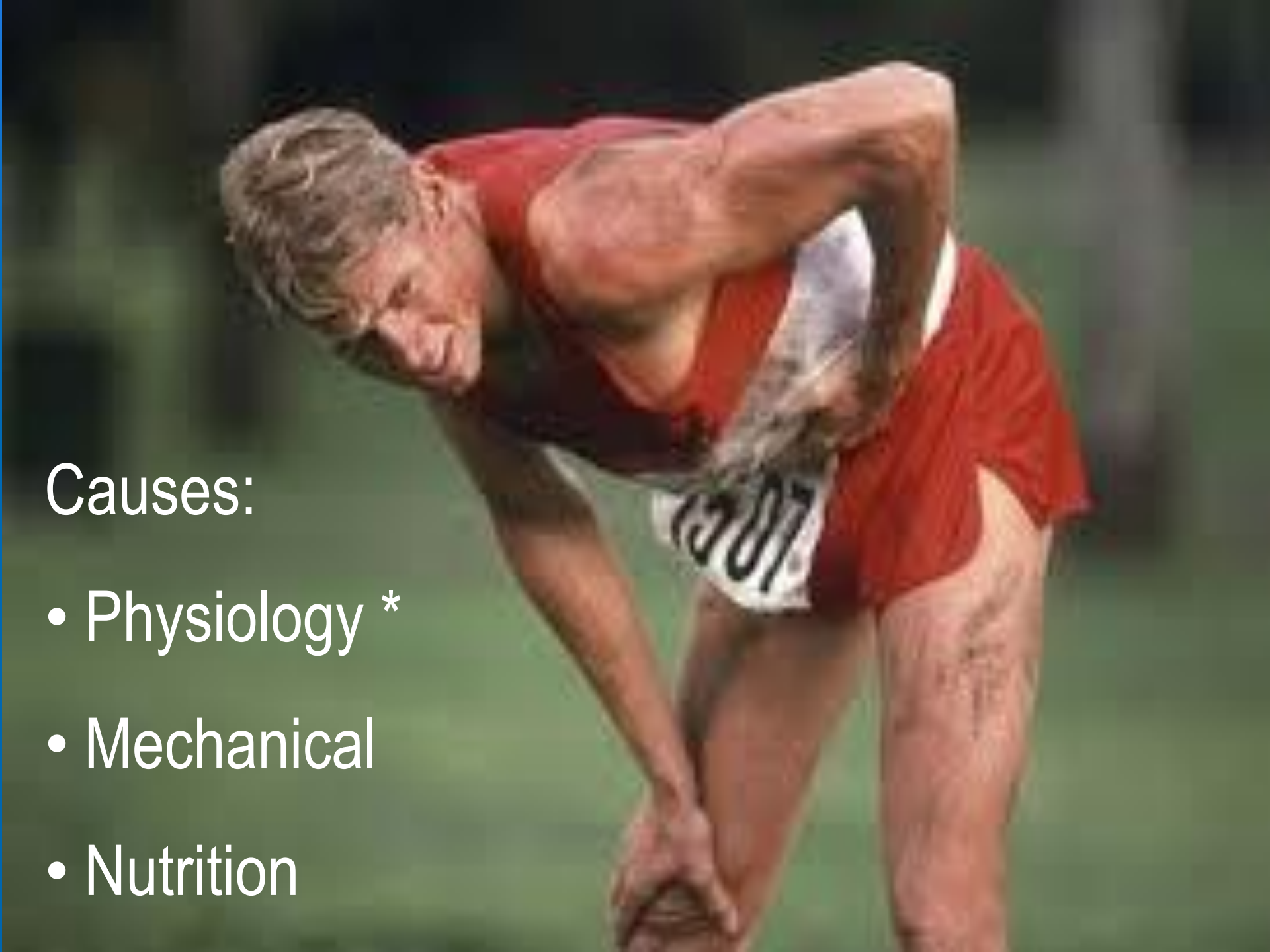
Causes:

- Physiology *
- Mechanical
- Nutrition

Physical Impact and Jostling



GI Symptoms: flatulence, urge to defecate, diarrhea, bloody feces



Causes:

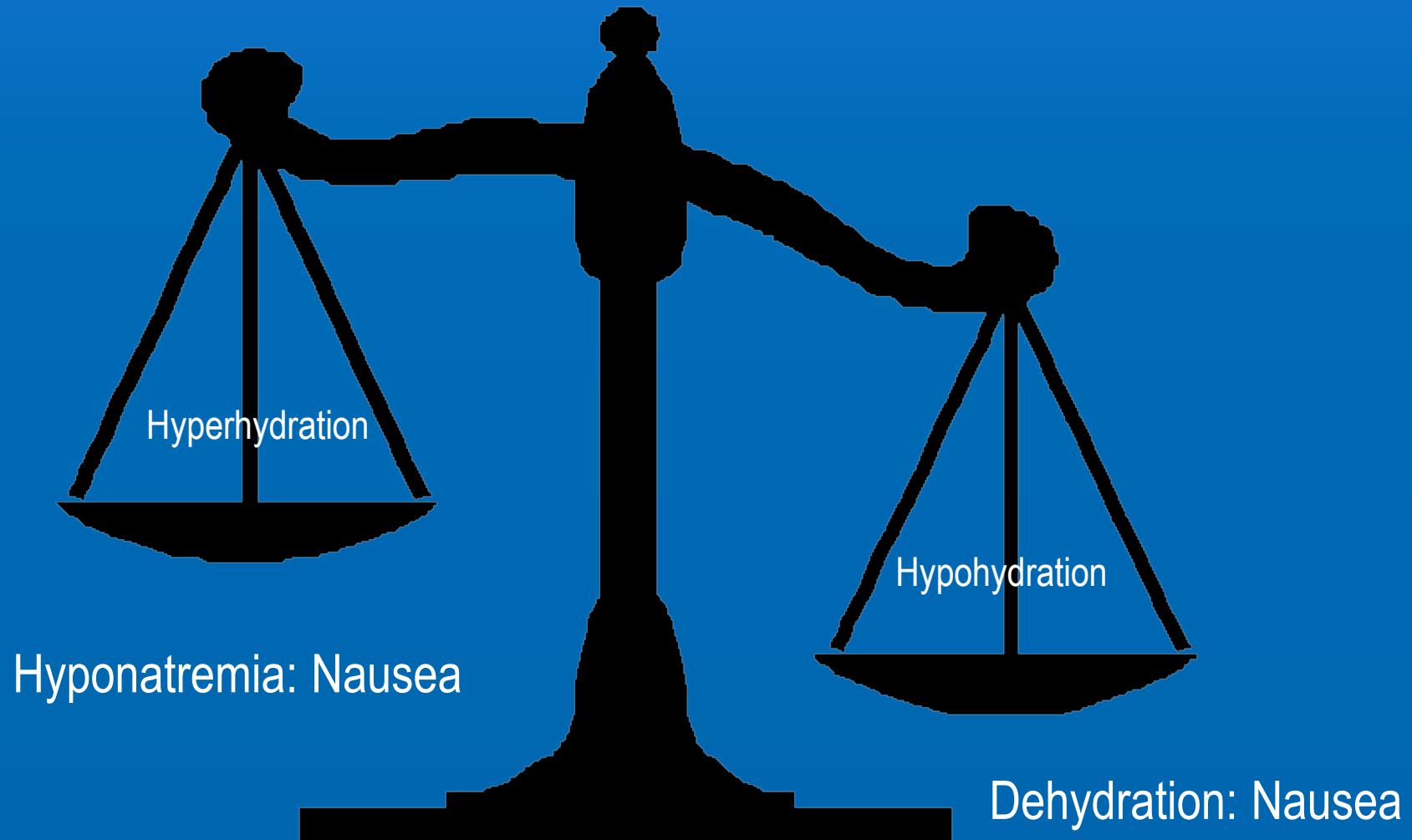
- Physiology *
- Mechanical
- Nutrition

NUTRITION



More research is needed!

NUTRITION: FLUID BALANCE



WSER 2013 GI DISTRESS STUDY



PURPOSE

To examine the incidence, severity, and timing of upper and lower GI symptoms in finishers and non-finishers of a 161-km ultramarathon

POST-RACE WEB-BASED SURVEY



SurveyMonkey.com
because knowledge is everything

- All starters
- Finishers and non-finishers
- GI distress and no GI distress
- GI symptoms during WSER 2013
- Previous GI symptoms

GI SYMPTOMS

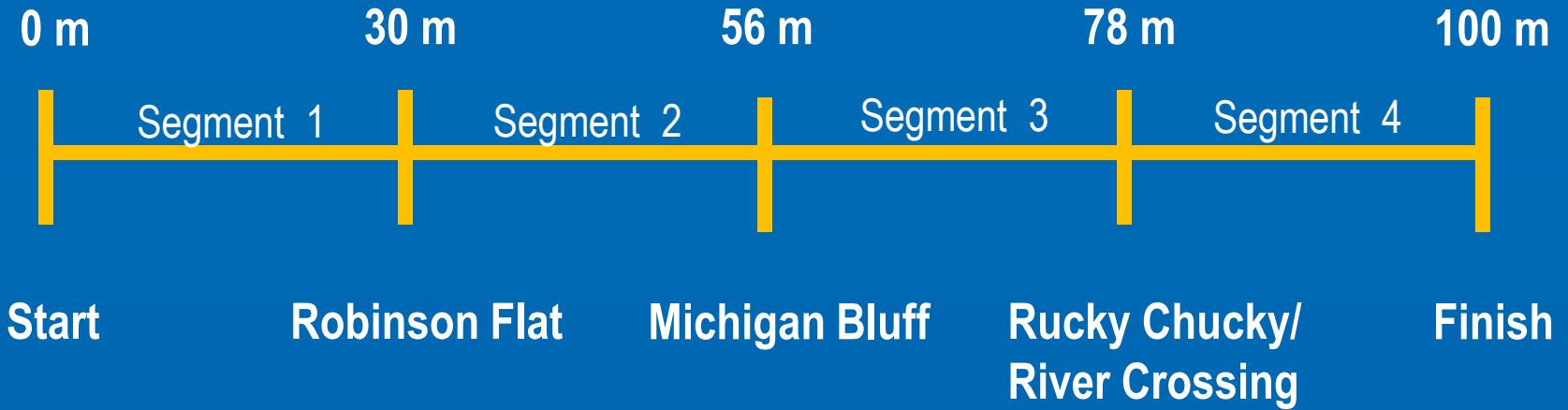
Upper GI Symptoms

- Reflux/heartburn
- Belching
- Stomach bloating
- Stomach cramps/pain
- Nausea
- Vomiting

Lower GI Symptoms

- Intestinal cramps/pain
- Flatulence
- Side ache/stitch
- Urge to defecate
- Loose stool/diarrhea
- Intestinal bleeding/bloody feces

GI SYMPTOMS BY RACE SEGMENT



GI SYMPTOM SEVERITY

None

Mild

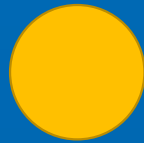
Moderate

Severe

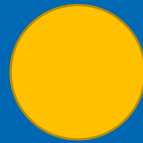
Very Severe



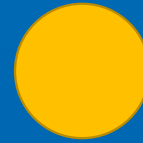
0



1



2



3



4

BODY WEIGHT



0 m

30 m

56 m

78 m

100 m



Start

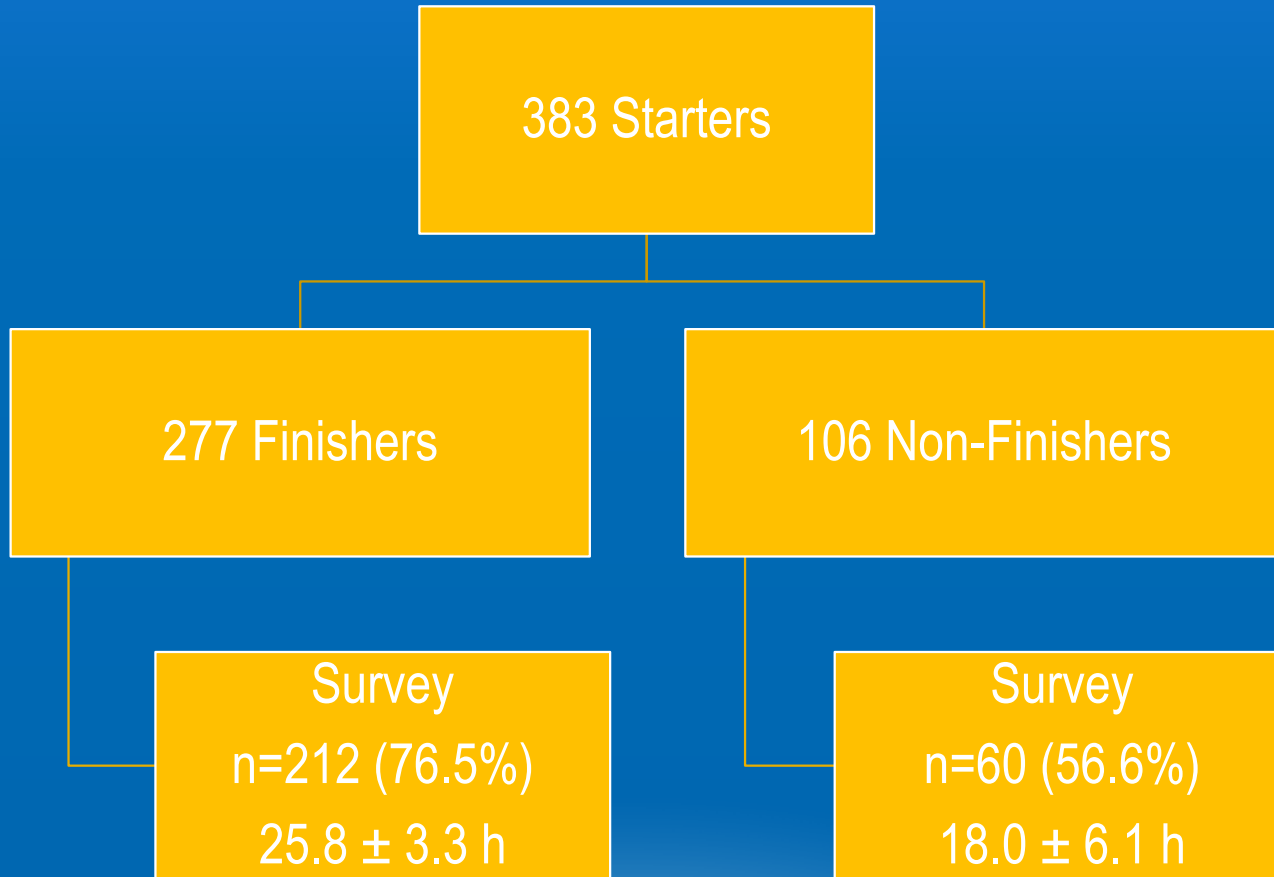
Robinson Flat

Michigan Bluff

Rucky Chucky/
River Crossing

Finish

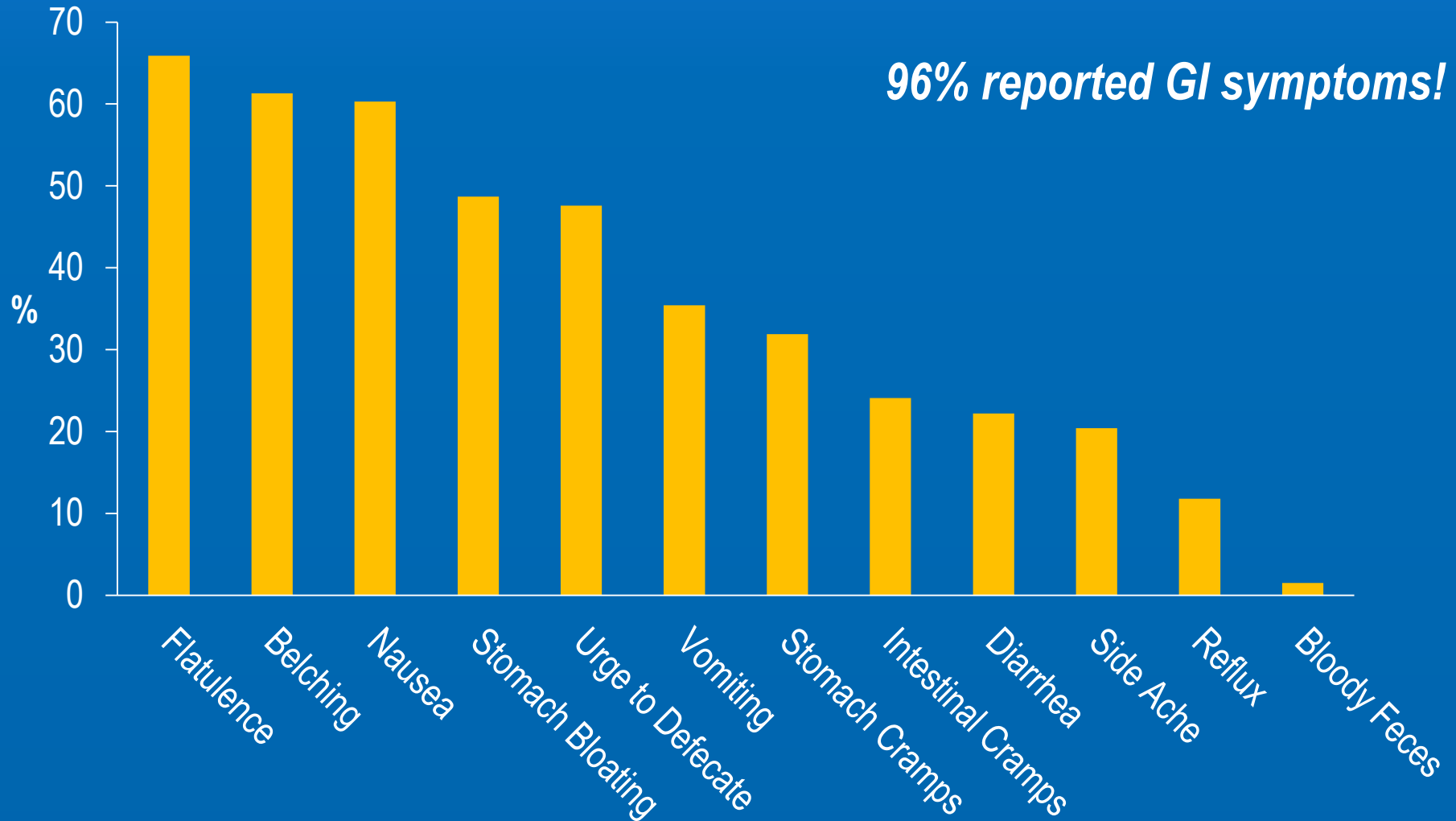
SUBJECTS



Survey
n=272

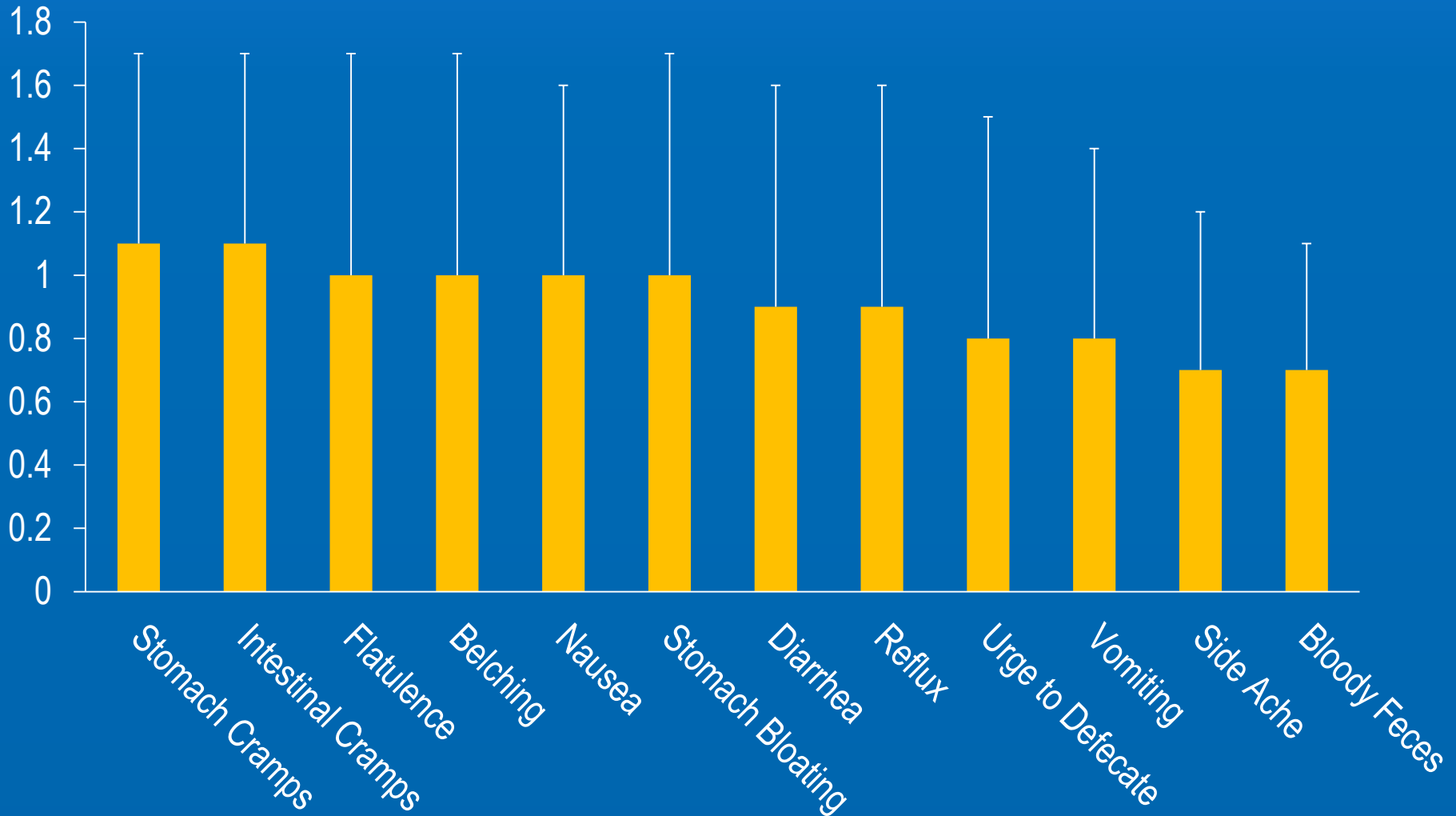
FREQUENCY OF GI SYMPTOMS

(n = 272)



SEVERITY OF GI SYMPTOMS

(n = 272)



If



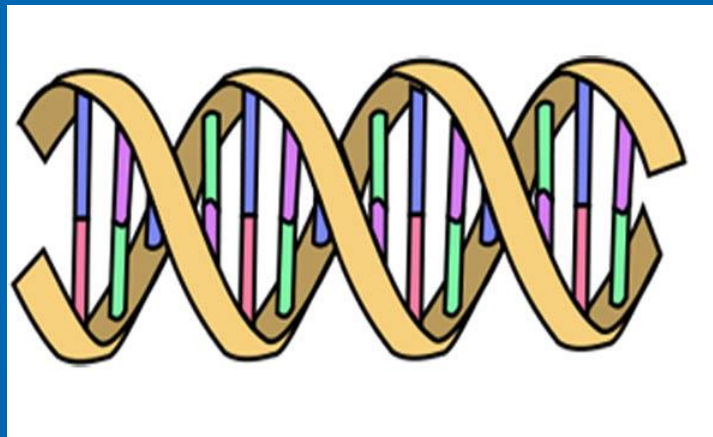
Then

- Flatulence
- Belching
- Nausea
- Stomach bloating

➤ *In the past while running*

- Flatulence
- Belching
- Nausea
- Stomach bloating

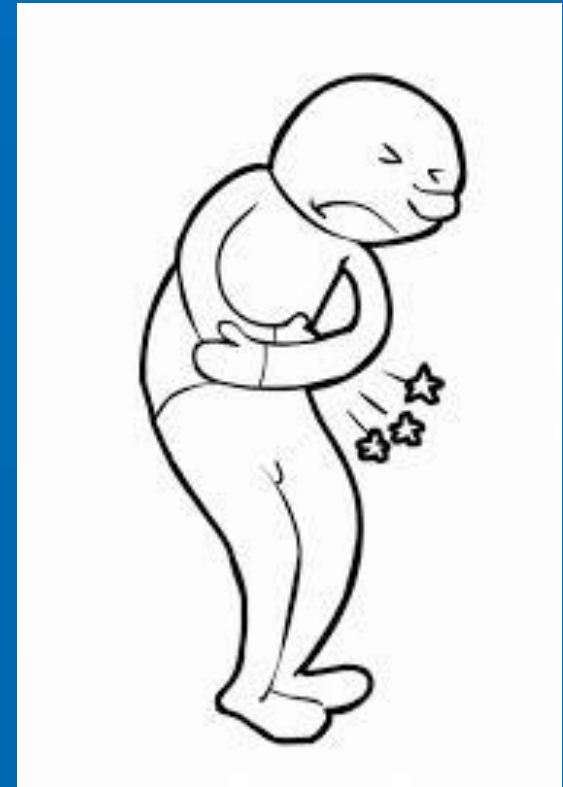
➤ *During the WSER 2013*



If



Then



Females more likely to have stomach bloating

If

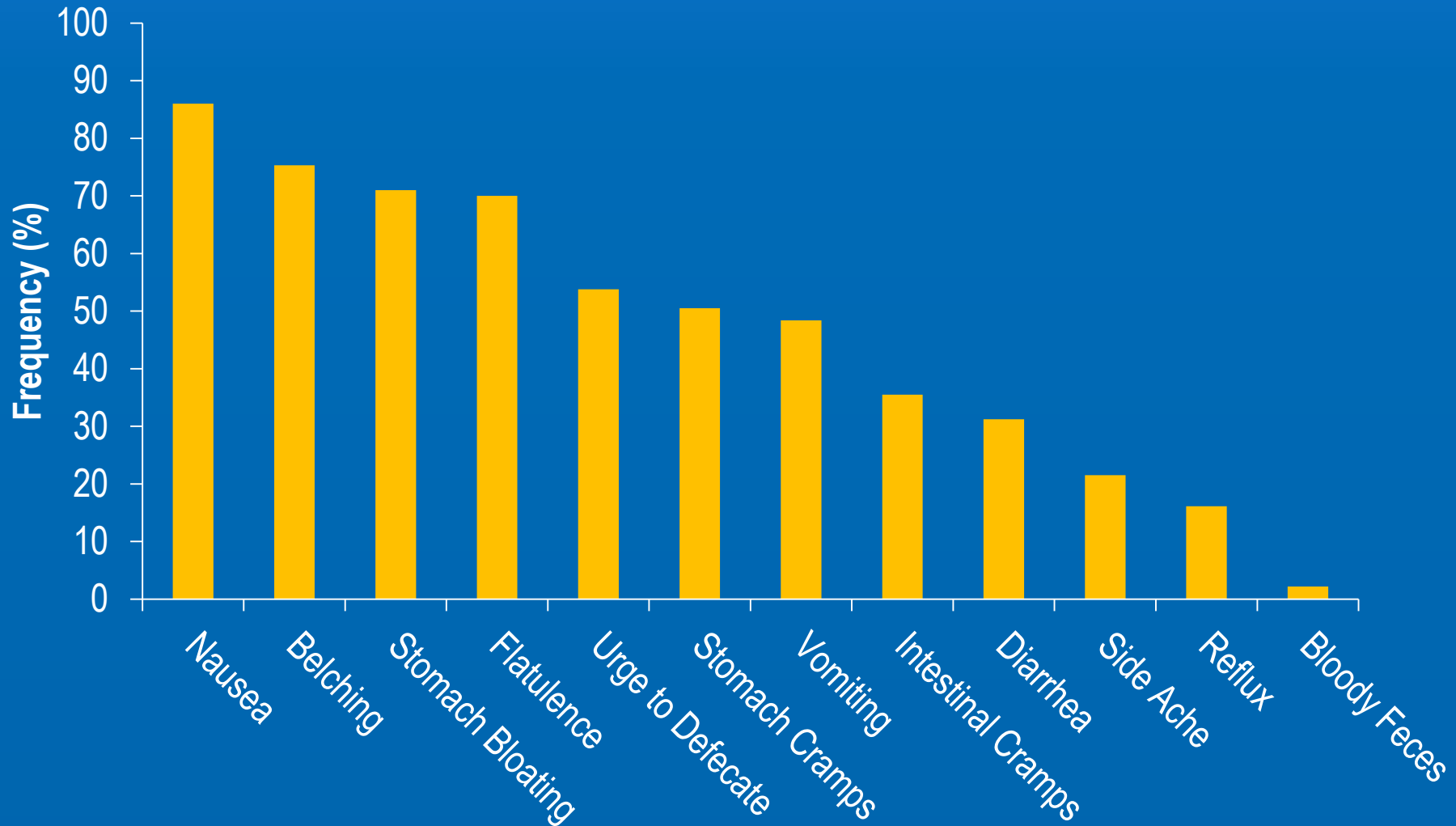


Then



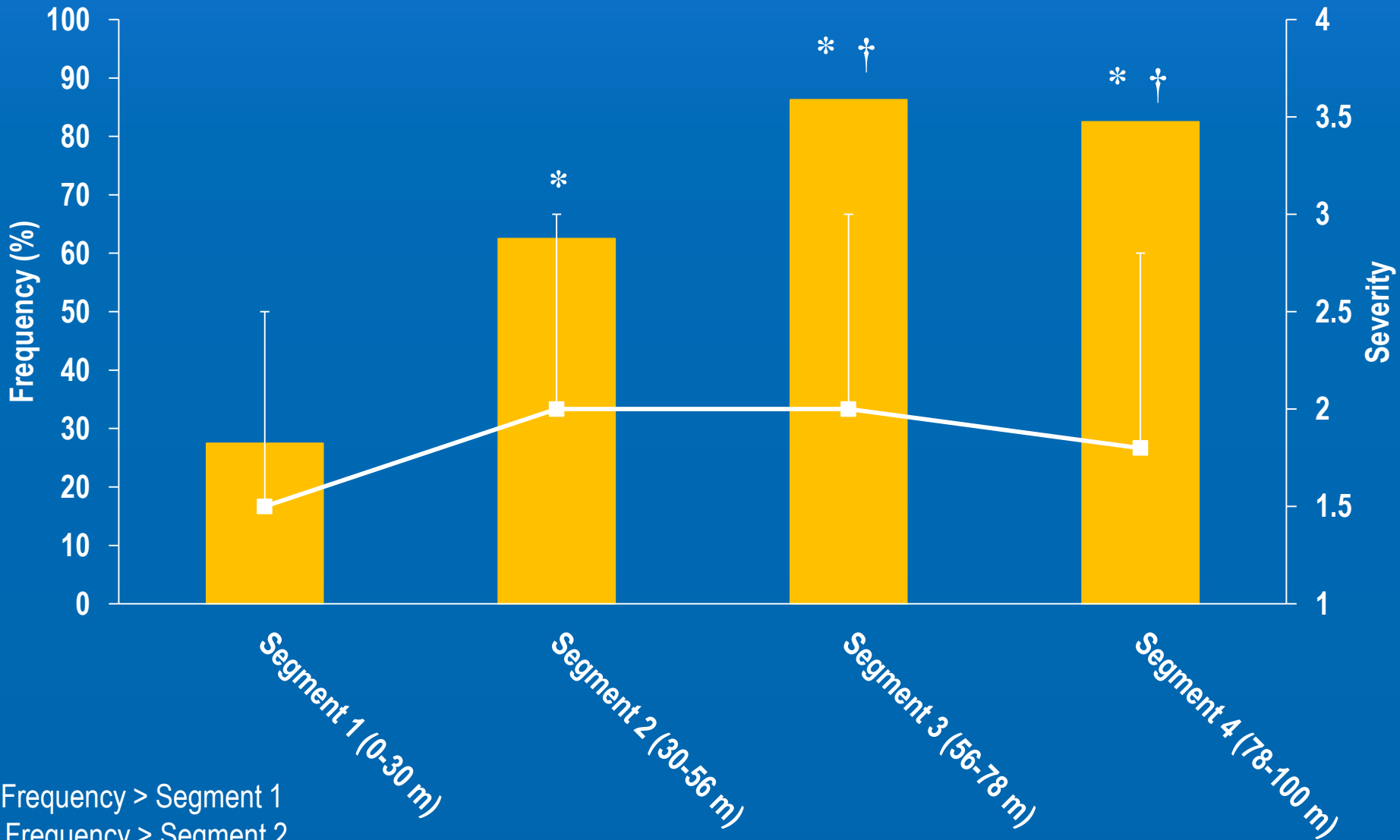
Finishers more likely to experience belching

FINISHERS, GI SYMPTOMS AFFECTED PERFORMANCE (44%; n = 93)

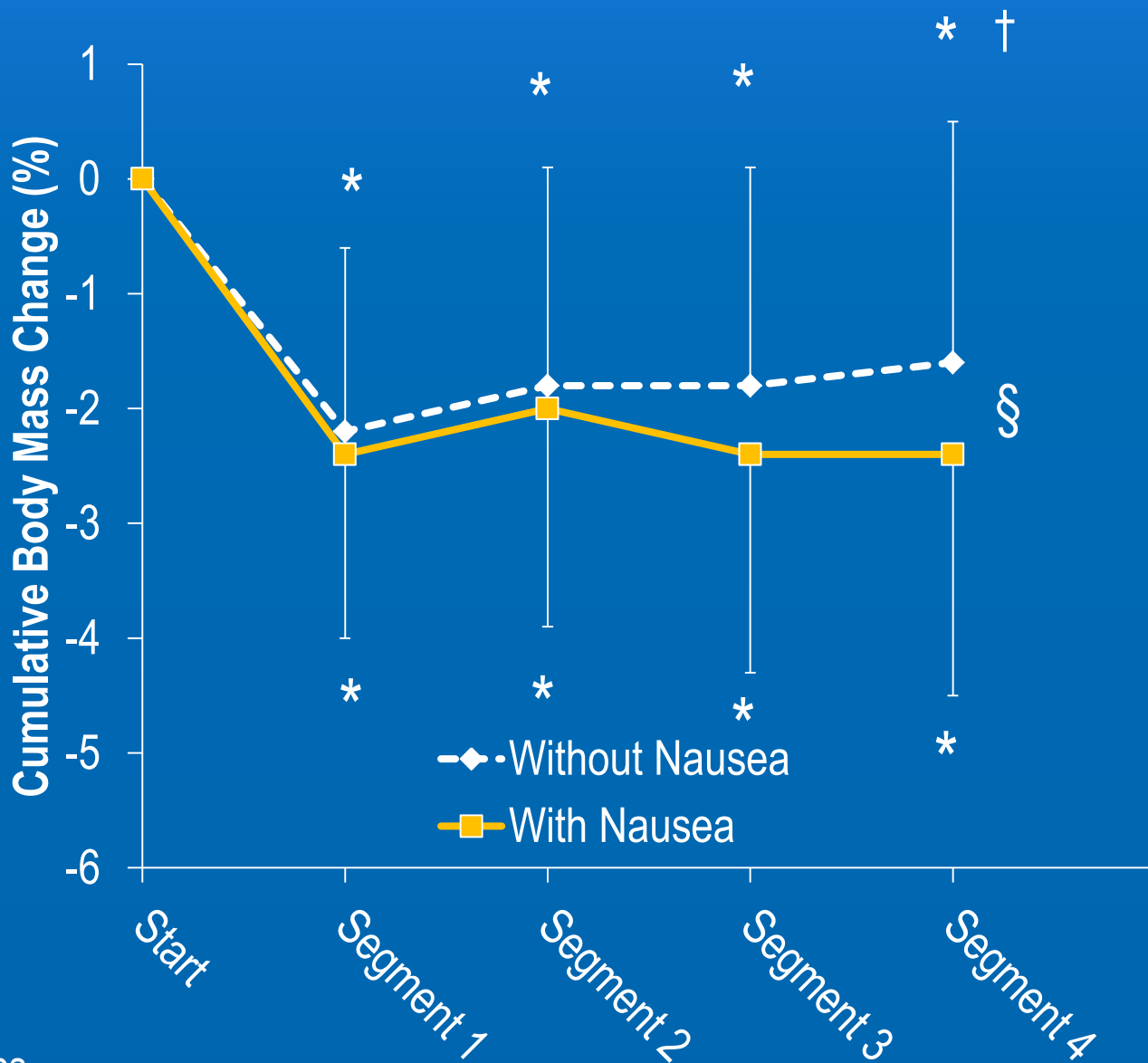


NAUSEA FREQUENCY AND SEVERITY BY SEGMENT

(n = 80)



CUMULATIVE BODY MASS CHANGE FOR FINISHERS BY NAUSEA STATUS

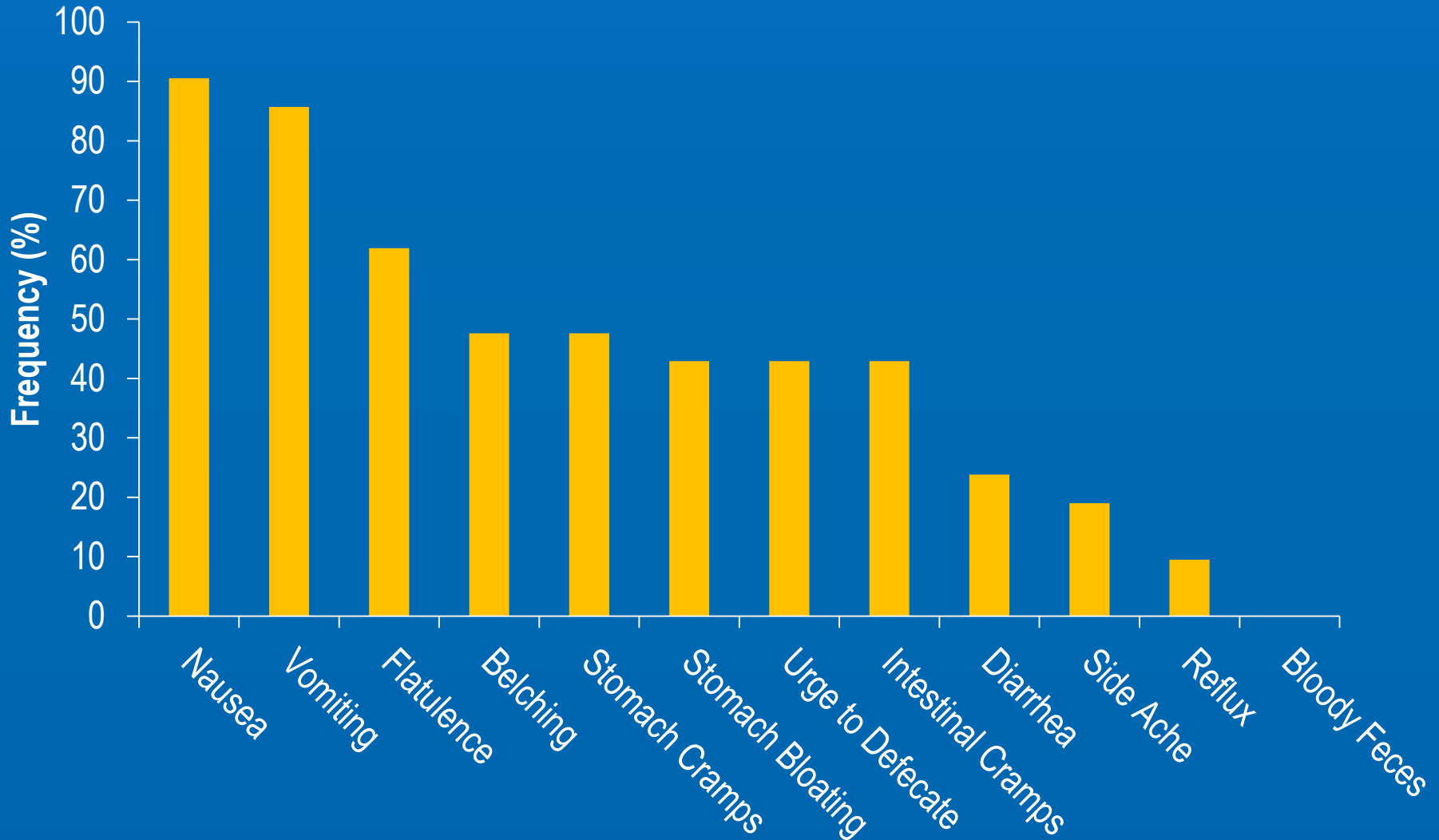


* < Start

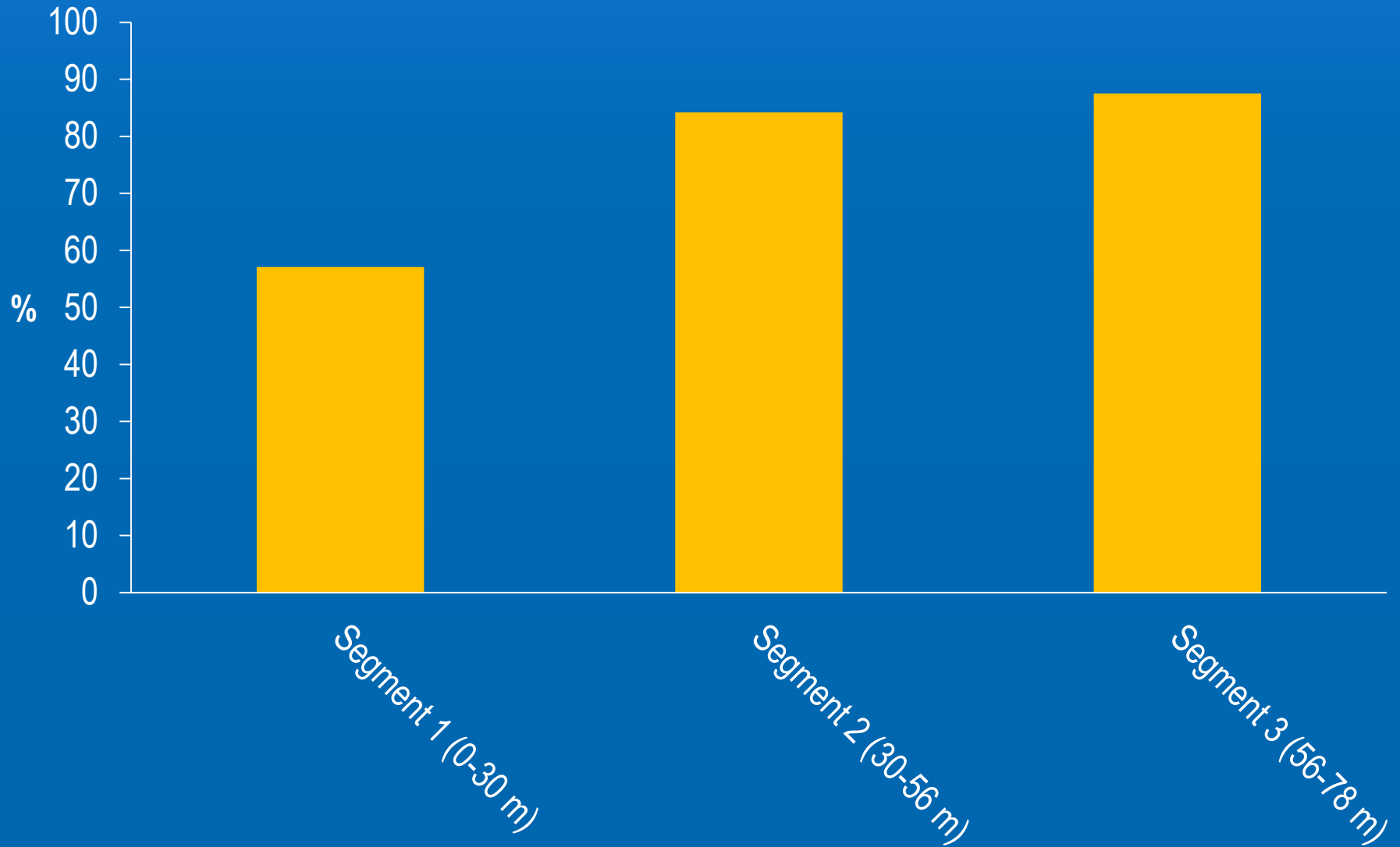
† Segment 1

§ Between Groups

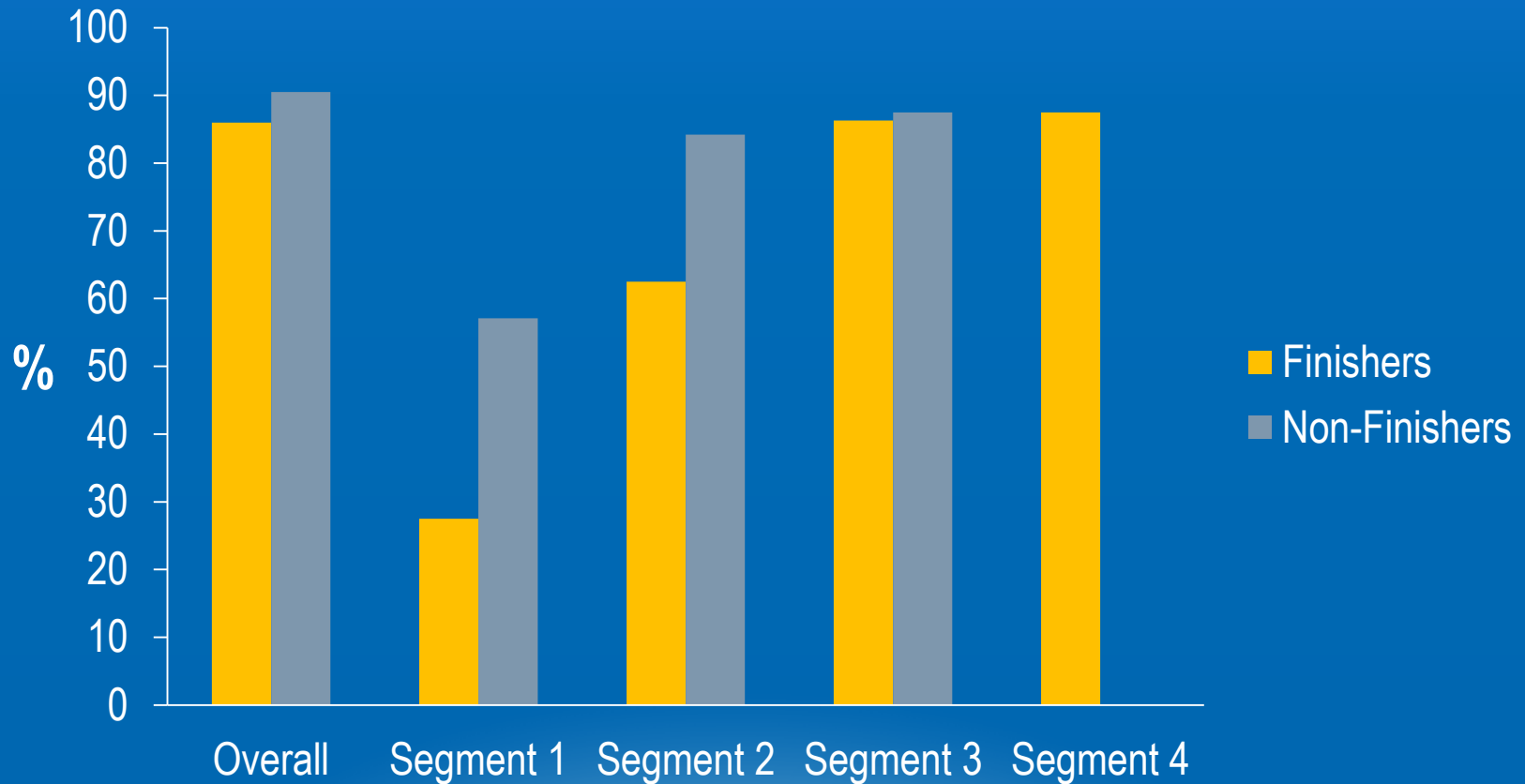
NON-FINISHERS, GI SYMPTOMS REASON FOR DROPPING OUT (36%; n = 21)



NON-FINISHERS NAUSEA FREQUENCY BY SEGMENT



FINISHERS AND NON-FINISHERS NAUSEA

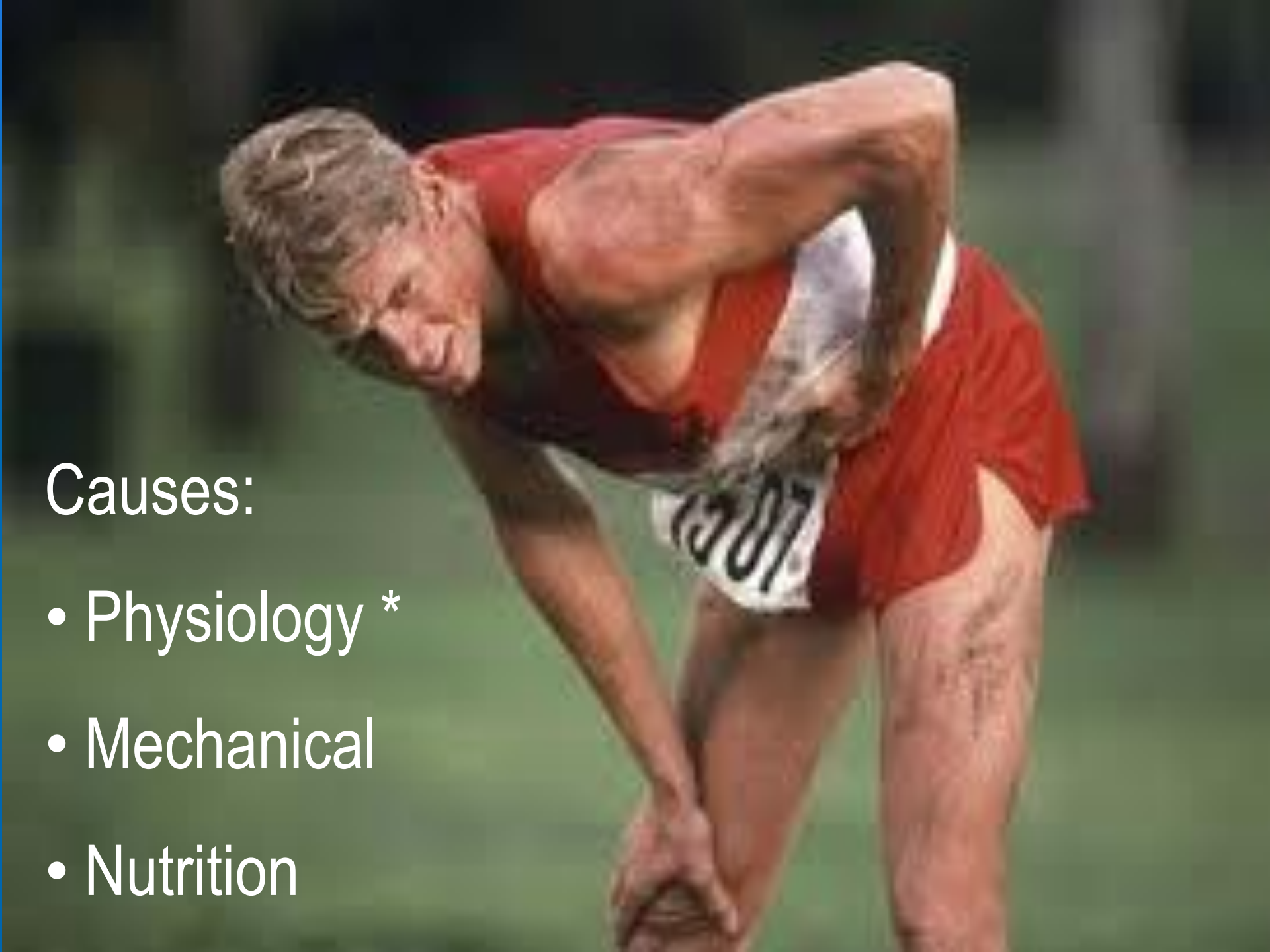


SUMMARY

- GI symptoms experienced by most runners (96%)
- Flatulence (66%), belching (61%), and nausea (60%) most common
- Finishers: GI symptoms affected performance in 44%
 - Nausea most common (86%)
- Non-Finishers: GI symptoms reason for dropping out in 36%
 - Nausea most common (91%)

CONCLUSION

- GI symptoms common during ultramarathon running
- Nausea most common in:
 - Finishers whose performance was affected by GI distress
 - Non-finishers who dropped out because of GI distress



Causes:

- Physiology *
- Mechanical
- Nutrition

IS RACE DIET ASSOCIATED WITH GI DISTRESS?



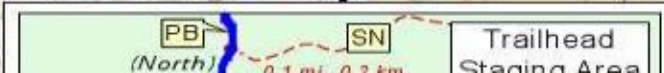
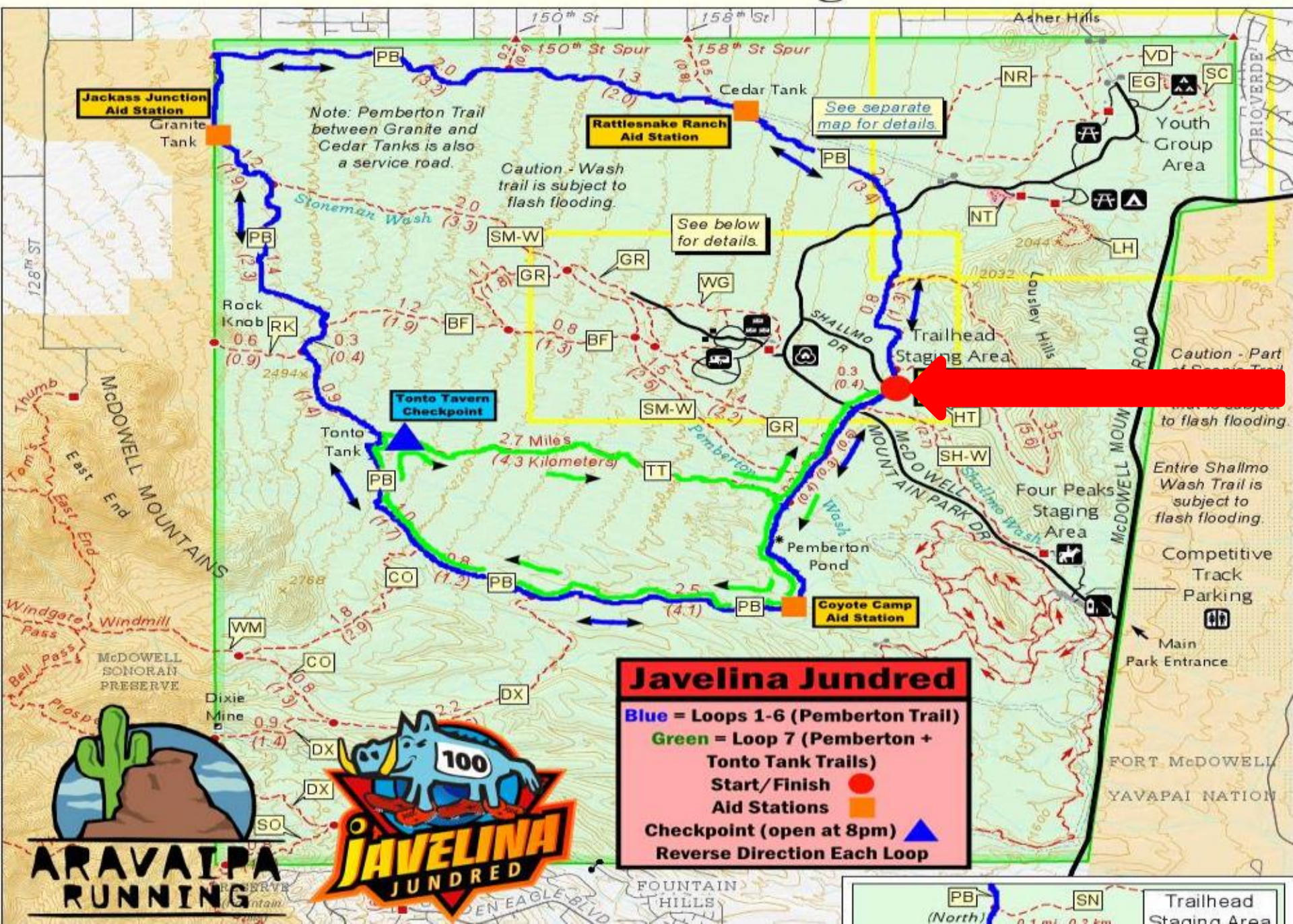
PURPOSE

Are food and fluid intake associated with GI distress in a 161-km ultramarathon?

Javelina Jundred



McDowell Mountain Regional Park





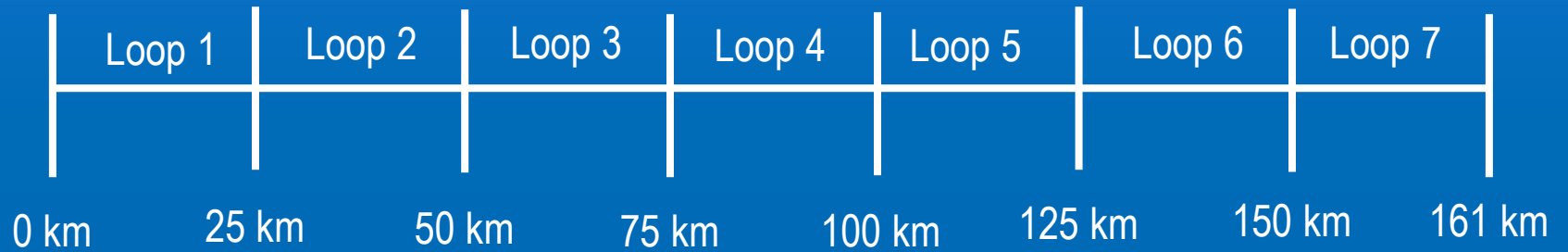
SUBJECTS

15 runners

➤ 10 male

➤ 5 female

RACE DIET INTERVIEWS





NUTRITIONIST PRO



Client Diet Record Nutrition Summary

First: Beth
Middle:
Last: Vitalis
Company:

Identification Number:
Date of Birth:
Height: Weight:

Total Days: 1
Avg. Daily Kcals: 10298.480
Total Foods: 32
Diet Name: WS 2009 Vitalis

Macronutrients	Value	Unit	Goal	%
Kilocalories	10298.48	kcal		*
	0			
Protein	130.642	g		*
Carbohydrate	2367.005	g		*
Fat, Total	62.779	g		*
Alcohol	0.000	g		*
Cholesterol	110.602	mg		*
Saturated Fat	14.571	g		*
Monounsaturated Fat	27.939	g		*
Polyunsaturated Fat	14.545	g		*
MFA 18:1, Oleic	27.152	g		*
PFA 18:2, Linoleic	12.900	g		*
PFA 18:3, Linolenic	1.612	g		*
PFA 20:5, EPA	0.002	g		*
PFA 22:6, DHA	0.008	g		*
Dietary Fiber, Total	13.287	g		*
Sugar, Total	897.340	g		*

Vitamins	Value	Unit	Goal	%
Vitamin A (RE)	2306.329	RE		*
Beta-Carotene	2832.852	µg		*
Vitamin C	2643.795	mg		*
Vitamin D (µg)	30.228	µg		*
Vitamin E (mg)	773.799	mg		*
Alpha-Tocopherol	3.210	mg		*
Thiamin	4.680	mg		*
Riboflavin	5.326	mg		*
Niacin	70.436	mg		*
Pyridoxine (Vitamin B6)	7.390	mg		*
Folate (Total)	1251.250	µg		*
Cobalamin (Vitamin B12)	20.089	µg		*
Biotin	2106.802	µg		*
Pantothenic Acid	71.872	mg		*
Vitamin K	211.629	µg		*

Amino Acids	Value	Unit	Goal	%
Tryptophan	1251.140	mg		*
Threonine	3841.823	mg		*
Isoleucine	4353.929	mg		*
Leucine	8720.817	mg		*
Lysine	6560.958	mg		*
Methionine	2297.172	mg		*
Cystine	770.807	mg		*
Phenylalanine	4291.970	mg		*
Tyrosine	3363.815	mg		*
Valine	5118.400	mg		*
Histidine	2138.030	mg		*

Minerals	Value	Unit	Goal	%
Sodium	23298.48	mg		*
	0			
Potassium	8765.444	mg		*
Calcium	3378.522	mg		*
Iron	40.063	mg		*
Phosphorus	3116.656	mg		*
Magnesium	1051.990	mg		*
Zinc	38.151	mg		*
Copper	5.276	mg		*
Manganese	7.025	mg		*
Selenium	173.977	µg		*
Chromium	1.300	mg		*
Molybdenum	222.033	µg		*

(* No Goal Value)

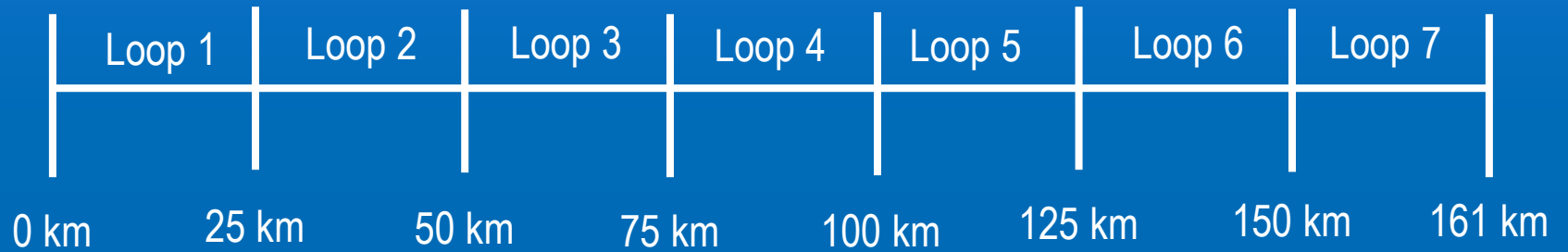
Exchanges	Value
Bread/Starch	5.50
Fat	2.50
Meat-High Fat	0.50
Meat-Lean	1.00
Meat-Medium Fat	0.50
Meat-Very Lean	1.00
Milk-Low Fat	0.50
Other Carbohydrate	24.00

Percentage Of Kcals

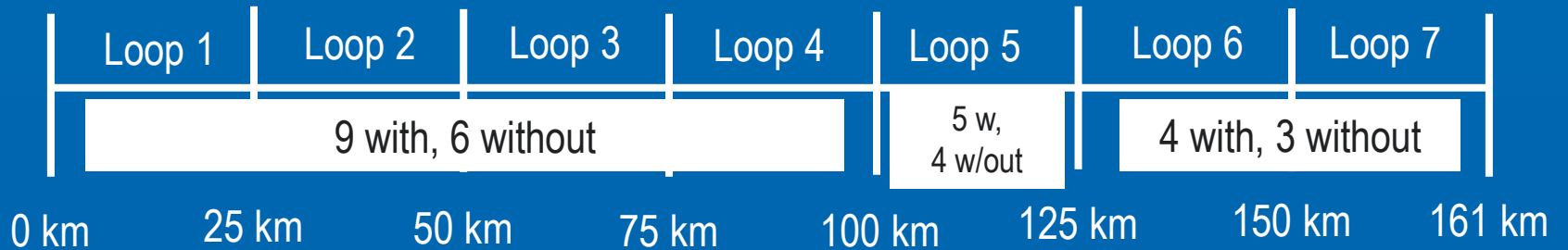
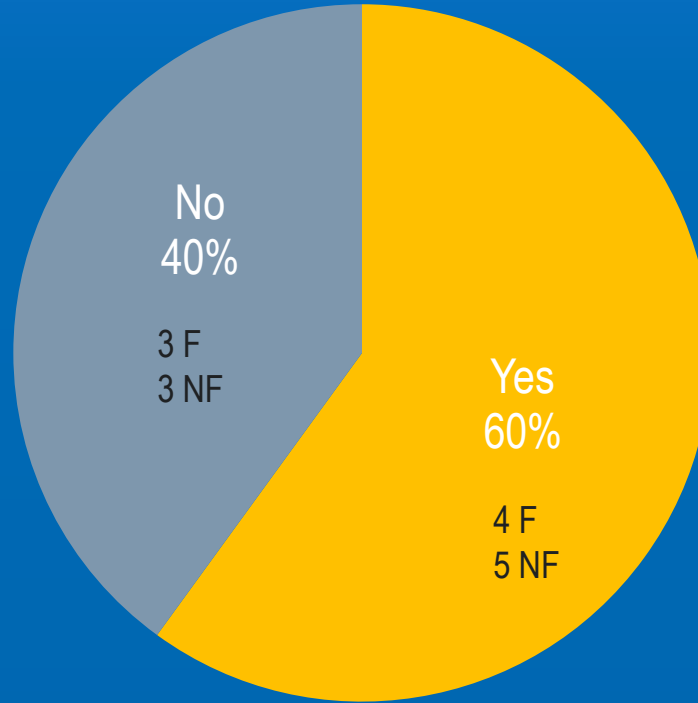


Protein 5.0%
Carbohydrate 89.7%
Total Fat 5.4%
Alcohol 0.0%

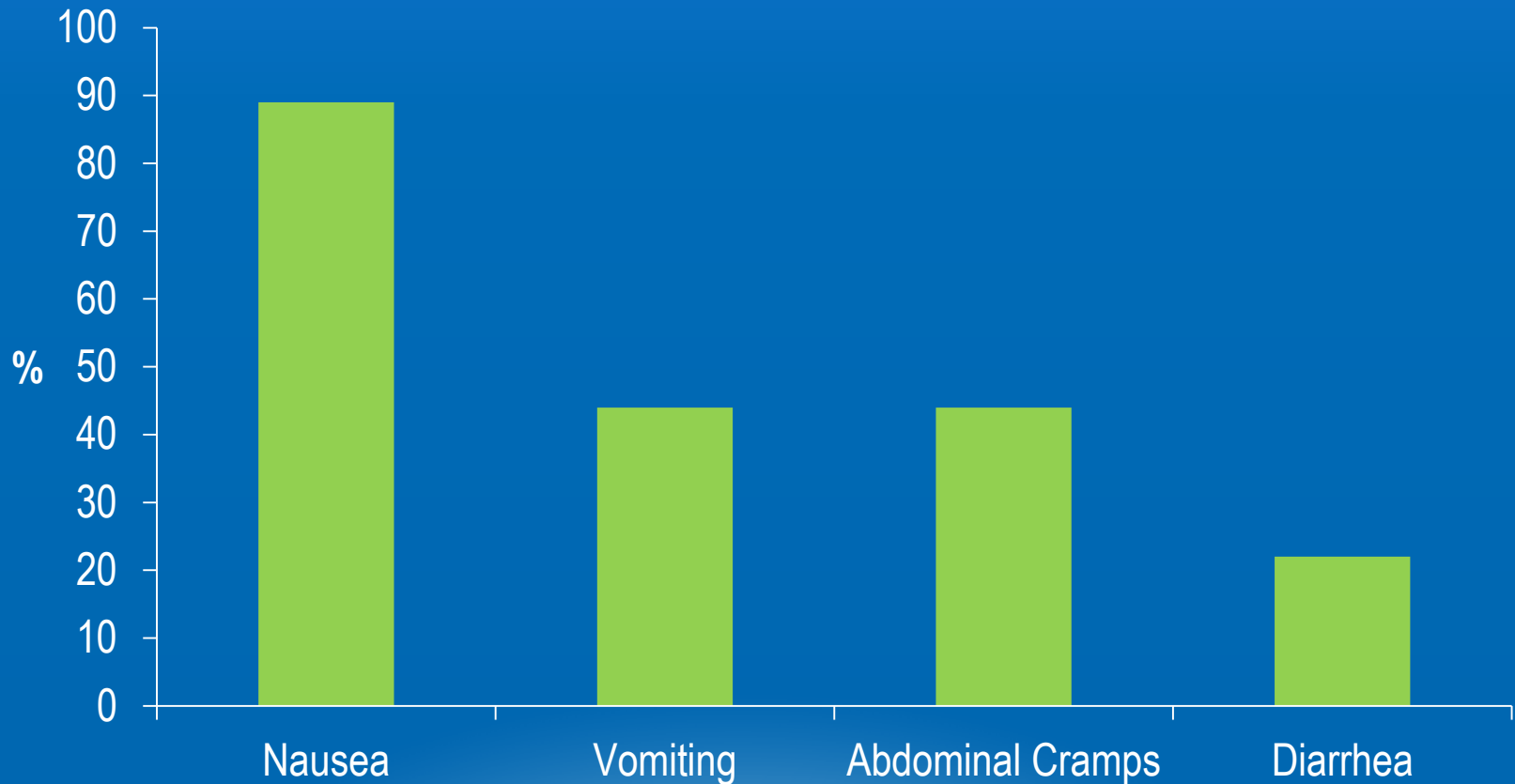
BODY MASS



GI DISTRESS



GI SYMPTOM FREQUENCY

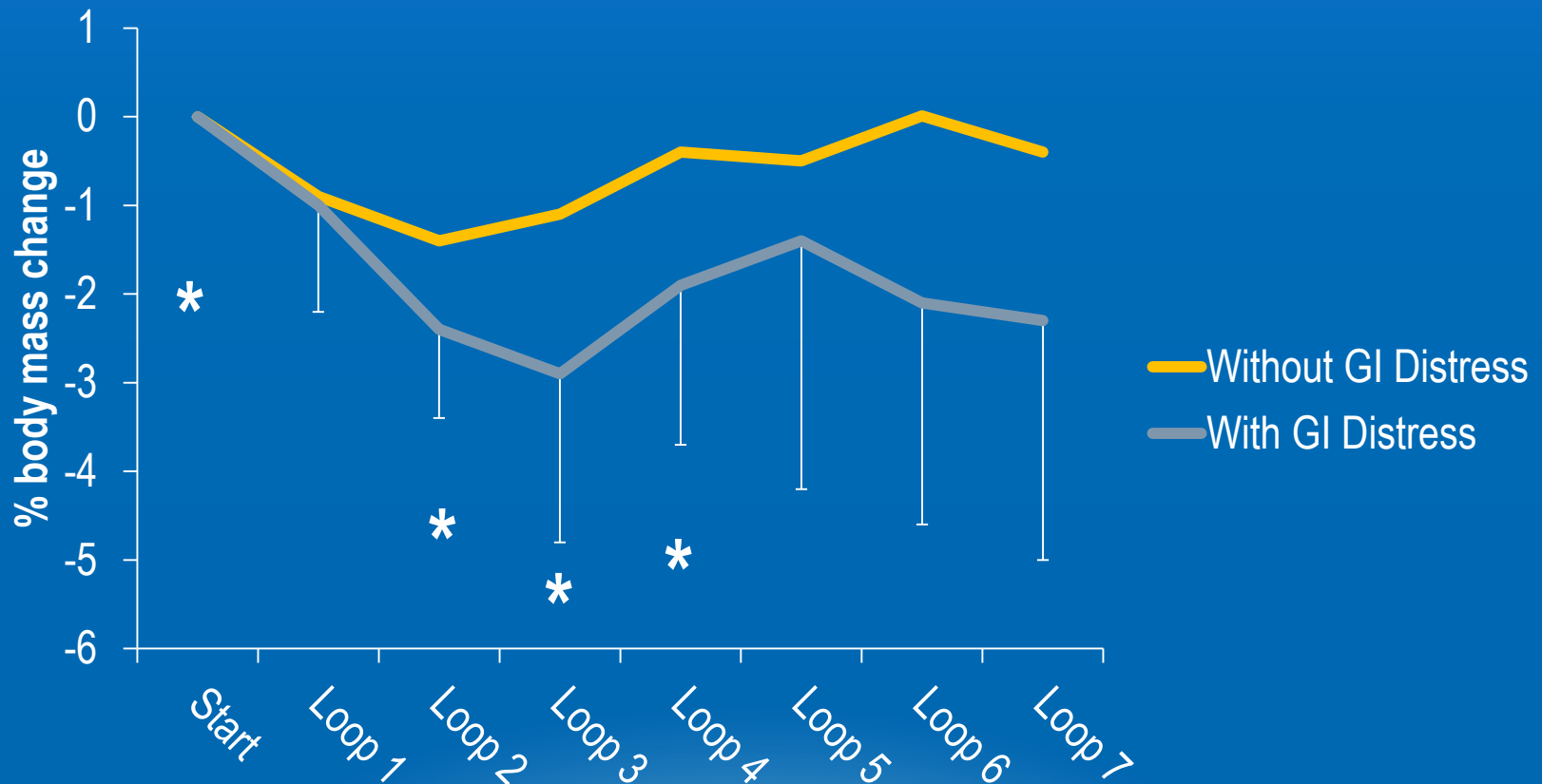


Start loops 3 and 4 (50-100 km; 31-62 m)

DEMOGRAPHIC COMPARISON

Variable	W/out GI Distress (n = 6)	W/ GI Distress (n = 9)
Age	42.2 ± 11.1	49.9 ± 11.2
Years running	10.7 ± 8.0	19.6 ± 14.6
Previous ultramarathons completed	4.7 ± 2.9	25.1 ± 36.2
Previous 161-km races completed	1.3 ± 2.0	4.8 ± 7.9
Kilometers	137.7 ± 30.2	128.7 ± 30.7
Time (h)	22.5 ± 5.4	22.9 ± 5.2

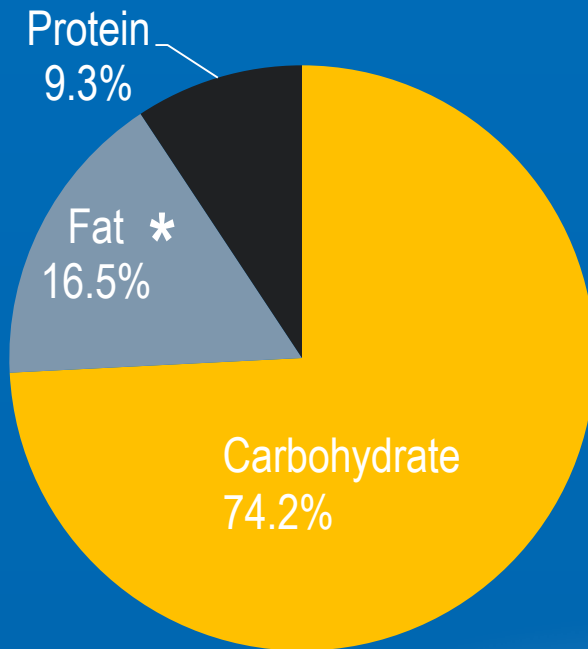
CUMULATIVE % BODY MASS CHANGE BY LOOP



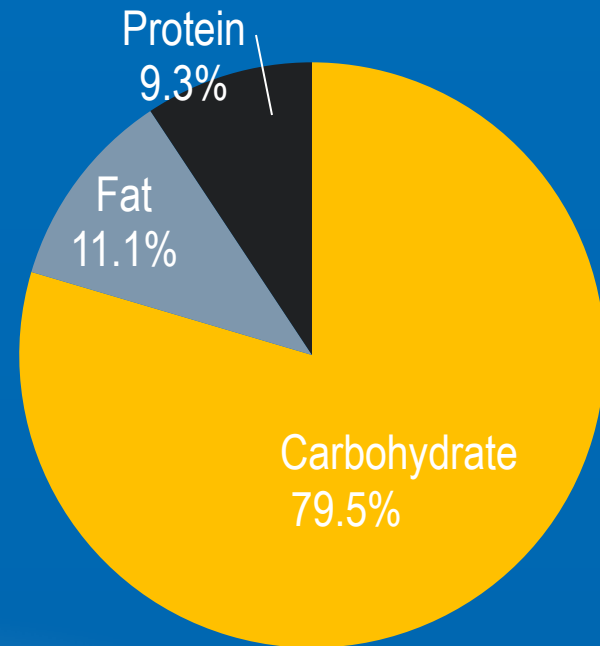
* $p < 0.05$ in runners with GI distress between the start and loops 2, 3, and 4

RACE DIET COMPOSITION

Without GI Distress

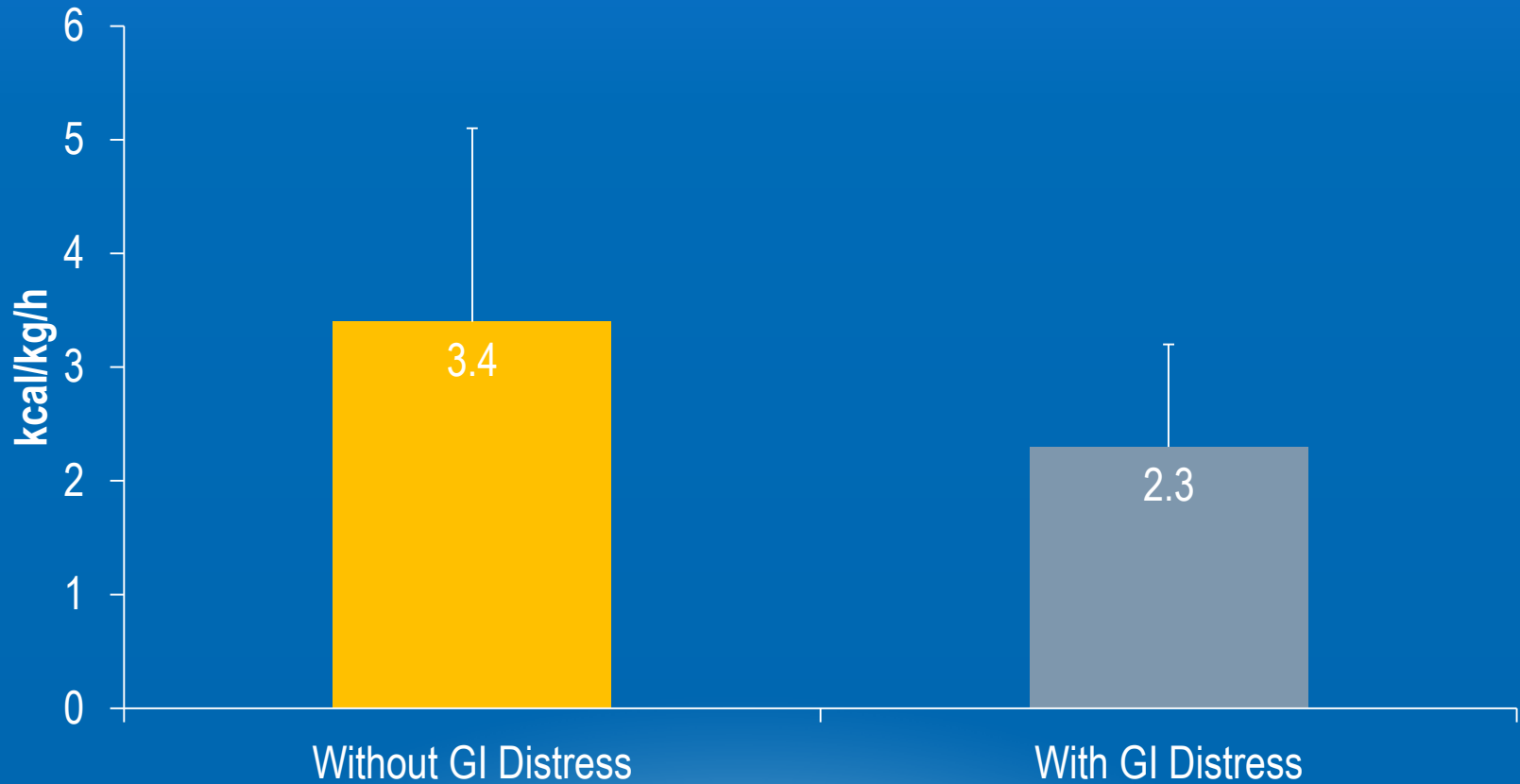


With GI Distress

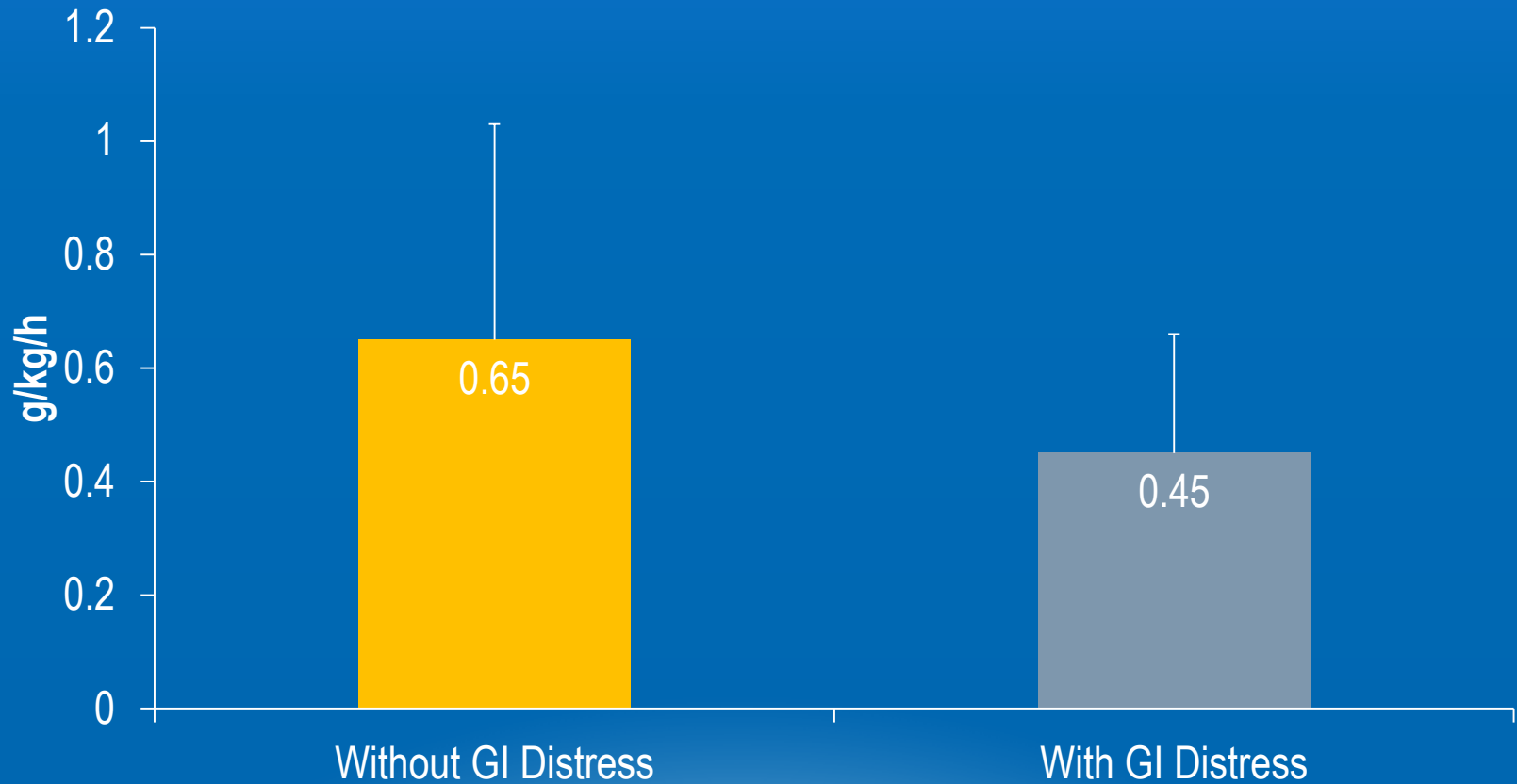


* $p < 0.05$ in runners without GI distress versus runners with GI distress.

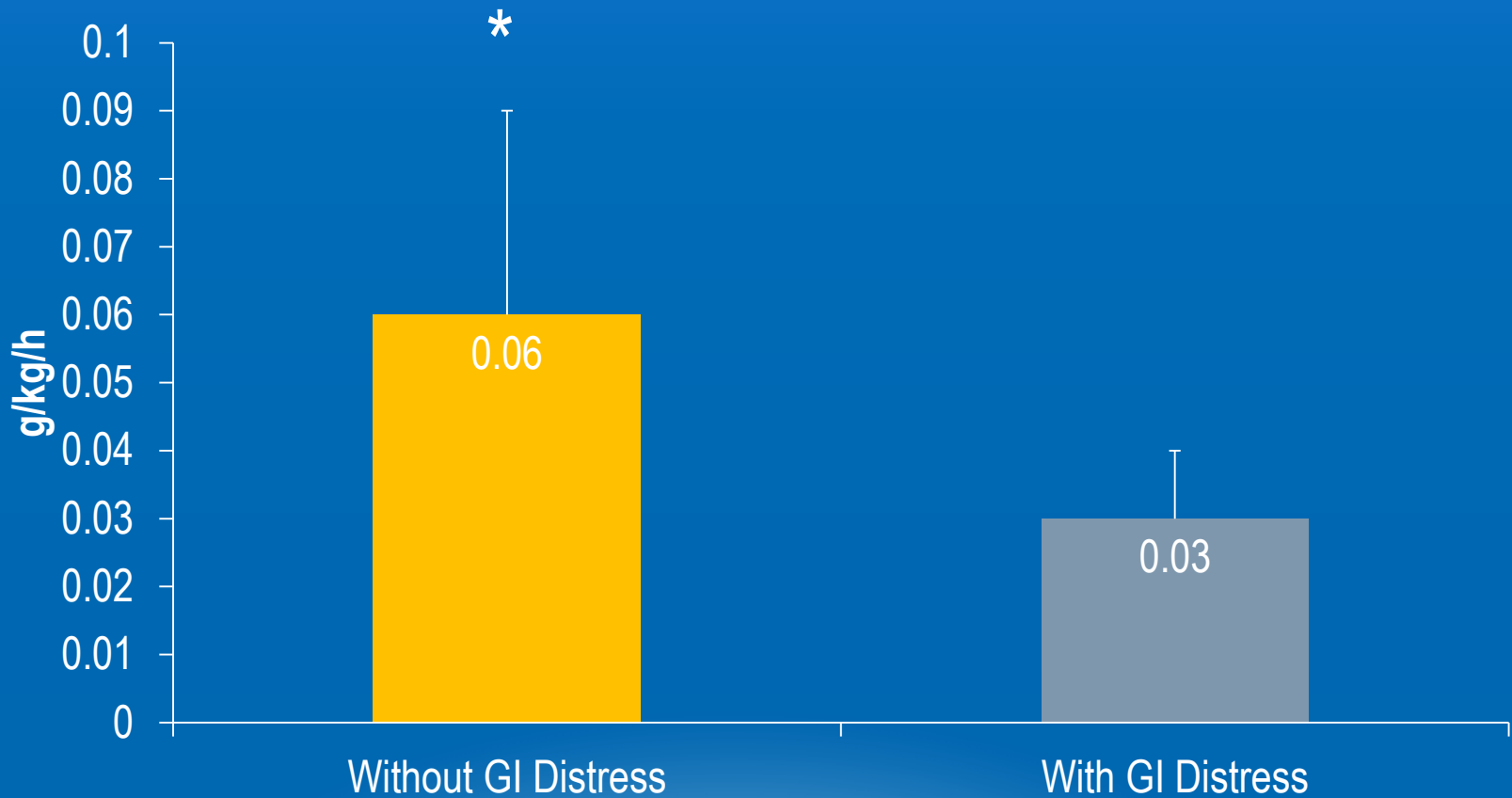
KCAL RATE



CARBOHYDRATE RATE

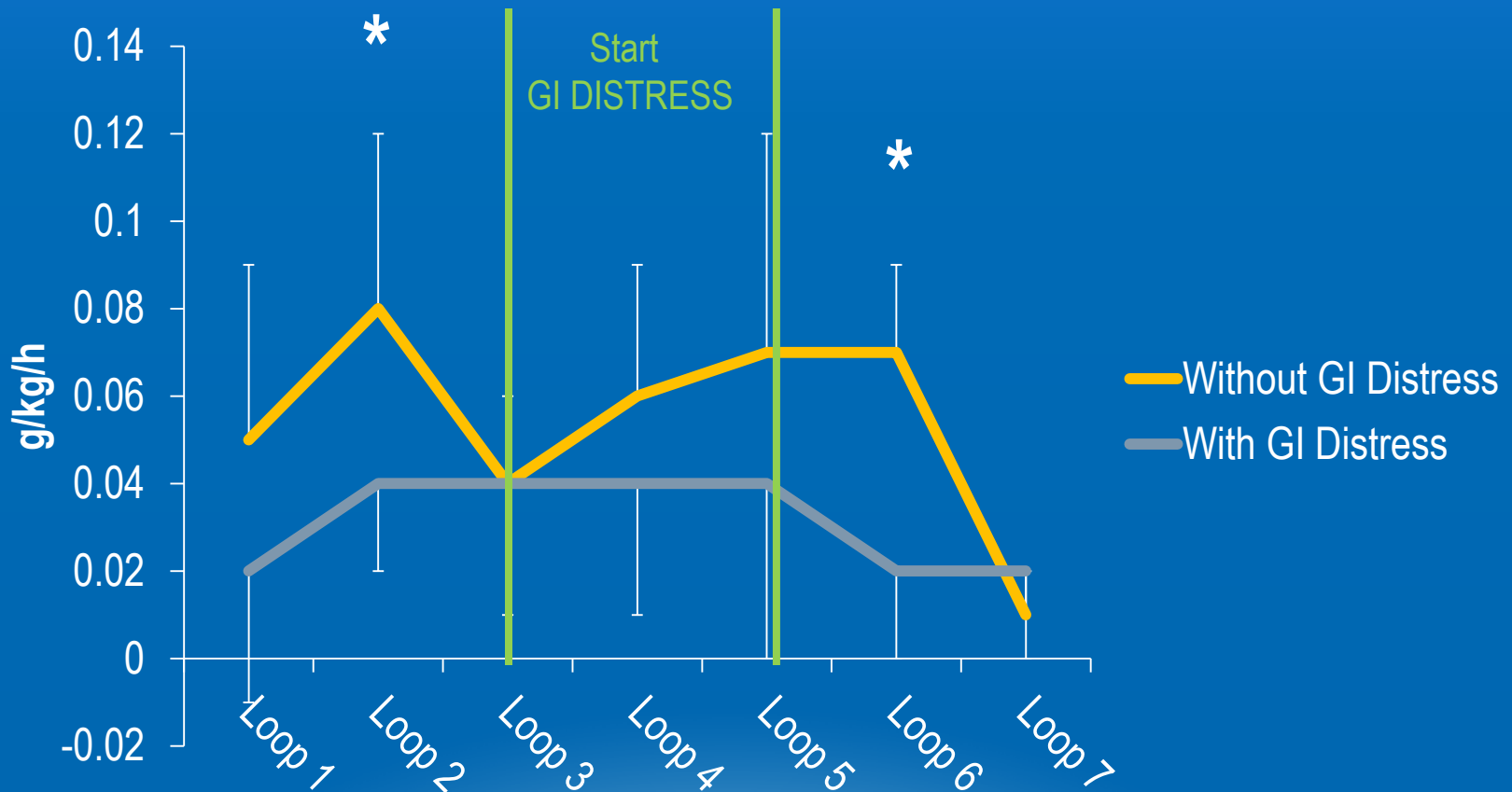


FAT RATE



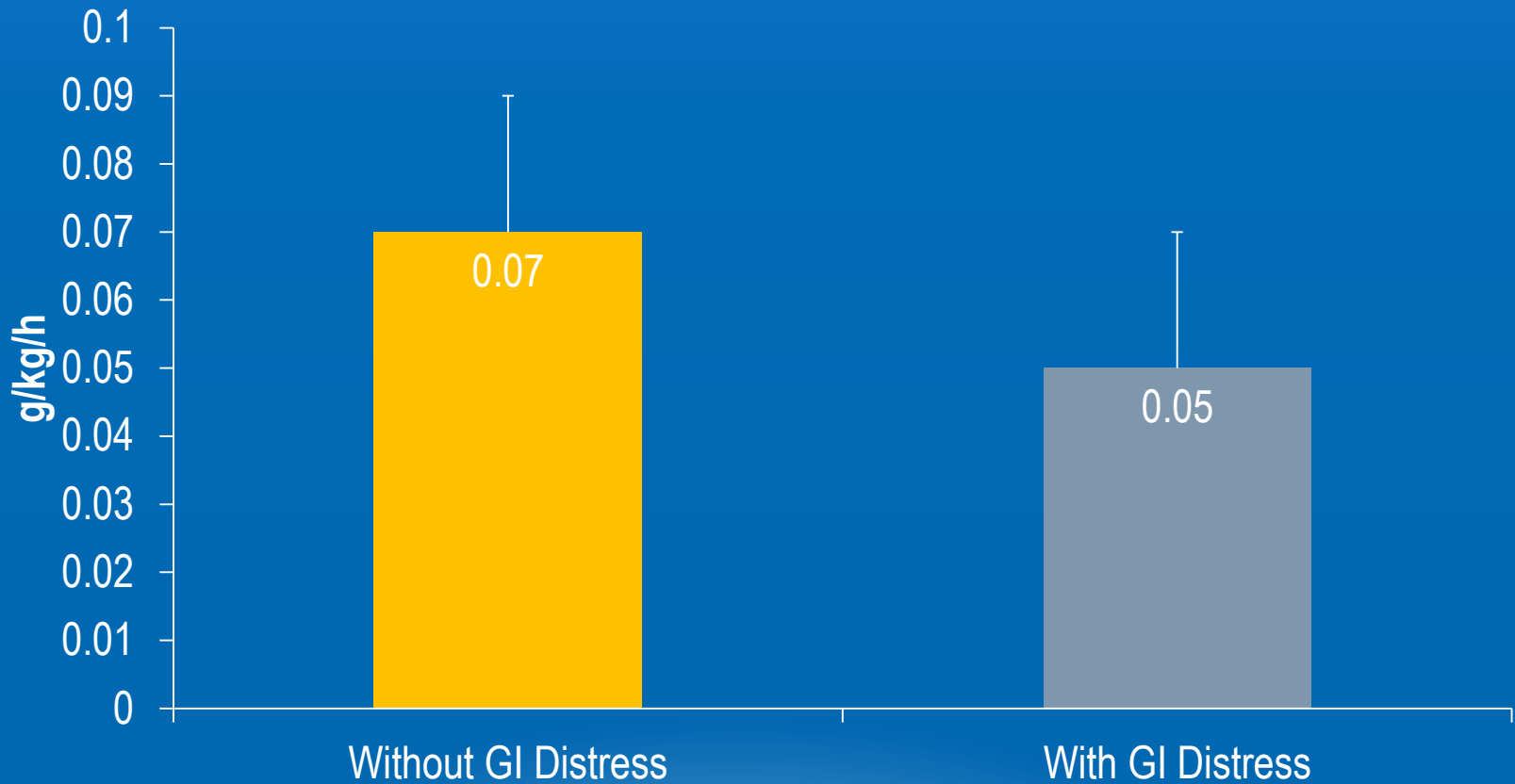
*p < 0.05 in runners without GI distress versus runners with GI distress.

FAT RATE BY LOOP

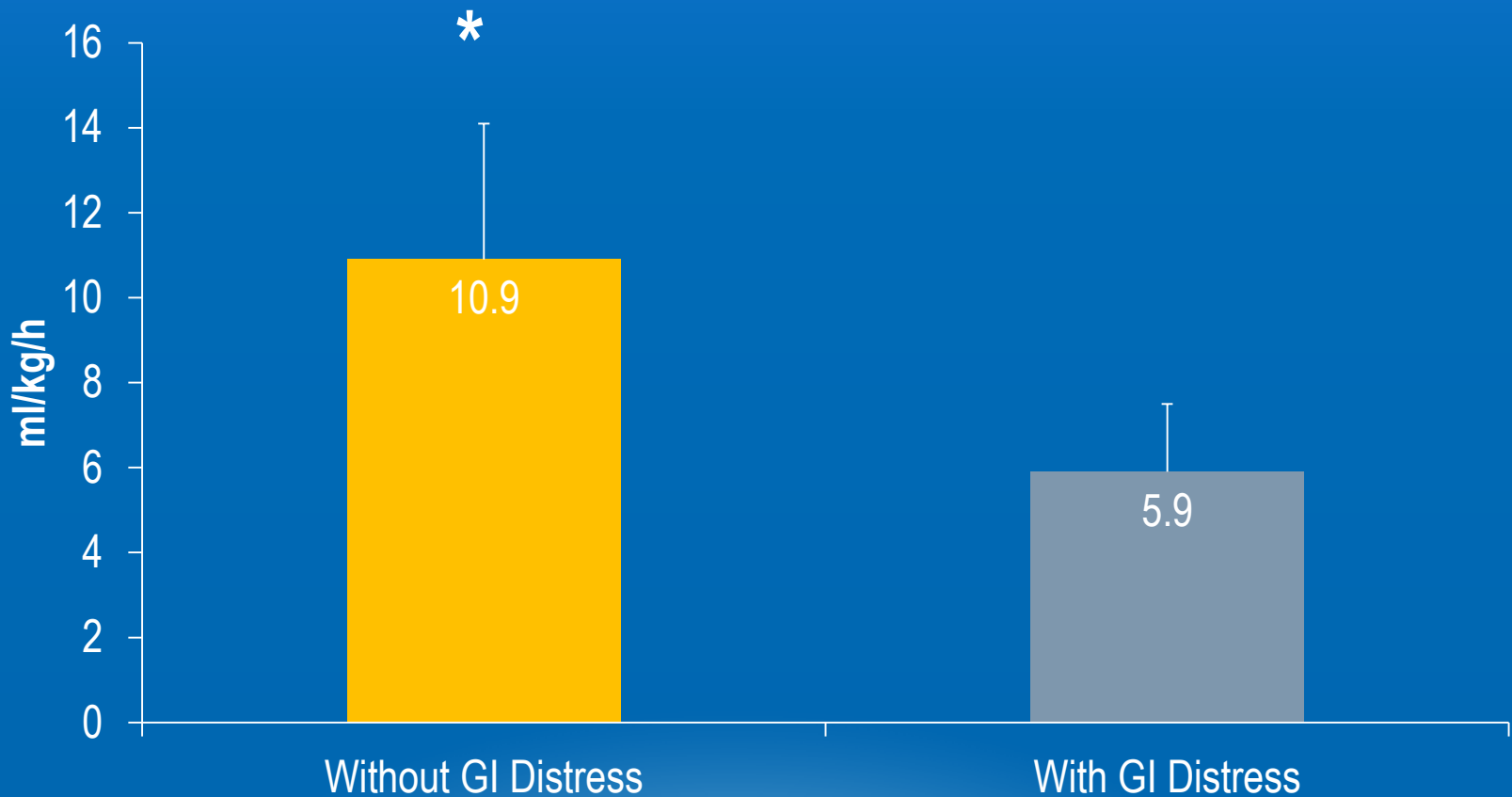


* $p < 0.05$ in runners without GI distress versus runners with GI distress.

PROTEIN RATE

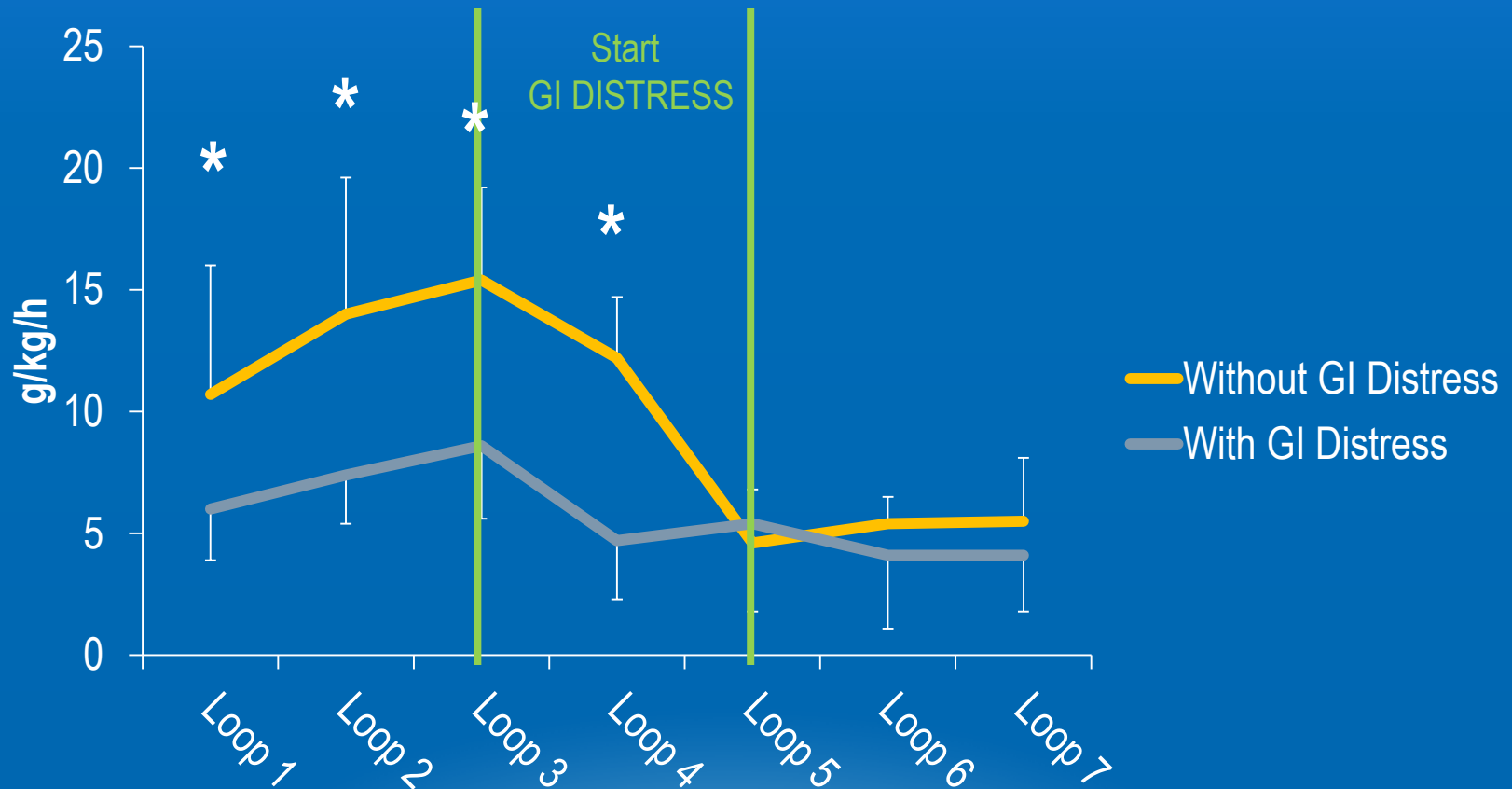


FLUID RATE



* $p < 0.05$ in runners without GI distress versus runners with GI distress.

FLUID RATE BY LOOP



* $p < 0.05$ in runners without GI distress versus runners with GI distress.

SUMMARY

RUNNERS W/OUT GI DISTRESS > RUNNERS W/ GI DISTRESS

- % Fat
- Fat consumption rate (g/kg/h)
- Fluid consumption rate (ml/kg/h)
- Differences evident *before* GI symptoms

CONCLUSION

Fluid and fat consumption *may* protect ultramarathoners from GI distress.

WSER 2014 GI DISTRESS STUDY



n = 20

GI DISTRESS INTERVIEWS



0 m

30 m

56 m

78 m

100 m



Start

Robinson Flat

Michigan Bluff

Rucky Chucky/
River Crossing

Finish

GI SYMPTOMS

Upper GI Symptoms

- Reflex/heartburn
- Belching
- Stomach bloating
- Stomach cramps/pain
- Nausea
- Vomiting

Lower GI Symptoms

- Intestinal cramps/pain
- Flatulence
- Side ache/stitch
- Urge to defecate
- Loose stool/diarrhea
- Intestinal bleeding/bloody feces

GI SYMPTOM SEVERITY

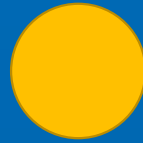
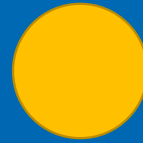
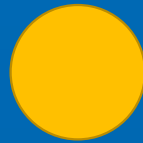
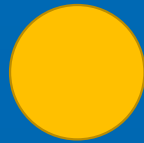
None

Mild

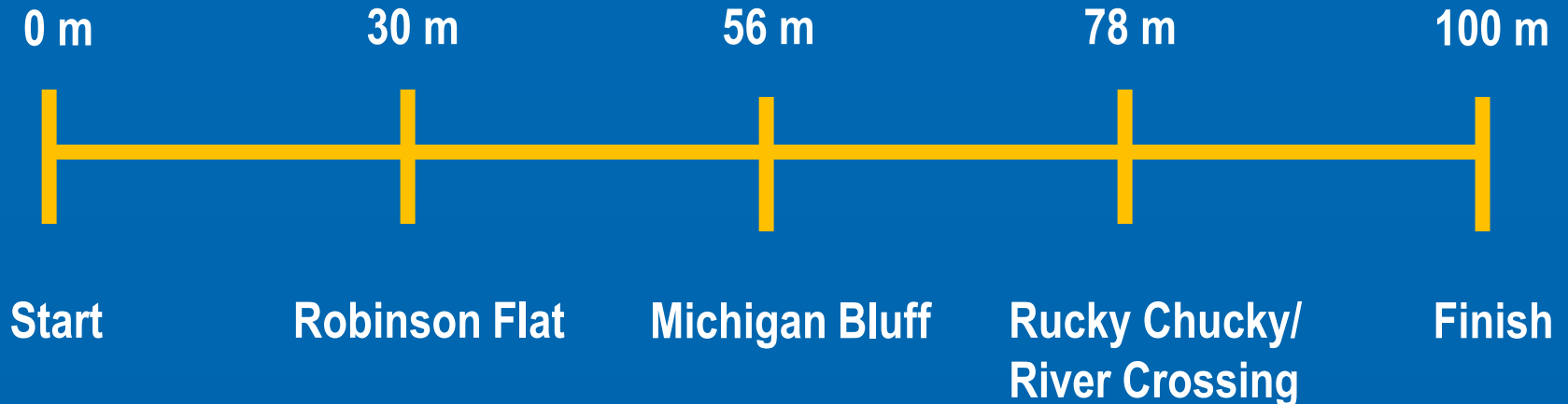
Moderate

Severe

Very Severe



RACE DIET INTERVIEWS



WEIGHTS



0 m

30 m

56 m

78 m

100 m



Start

Robinson Flat

Michigan Bluff

Rucky Chucky/
River Crossing

Finish

CORE TEMPERATURE



0 m

30 m

56 m

78 m

100 m



Start

Robinson Flat

Michigan Bluff

Rucky Chucky/
River Crossing

Finish

BLOOD DRAW



Biomarkers

- LPS
- sCD14
- IL-6
- CRP

INTERESTED IN BEING A SUBJECT?

Taylor Valentino

Kristin Stuempfle

THANK YOU

