

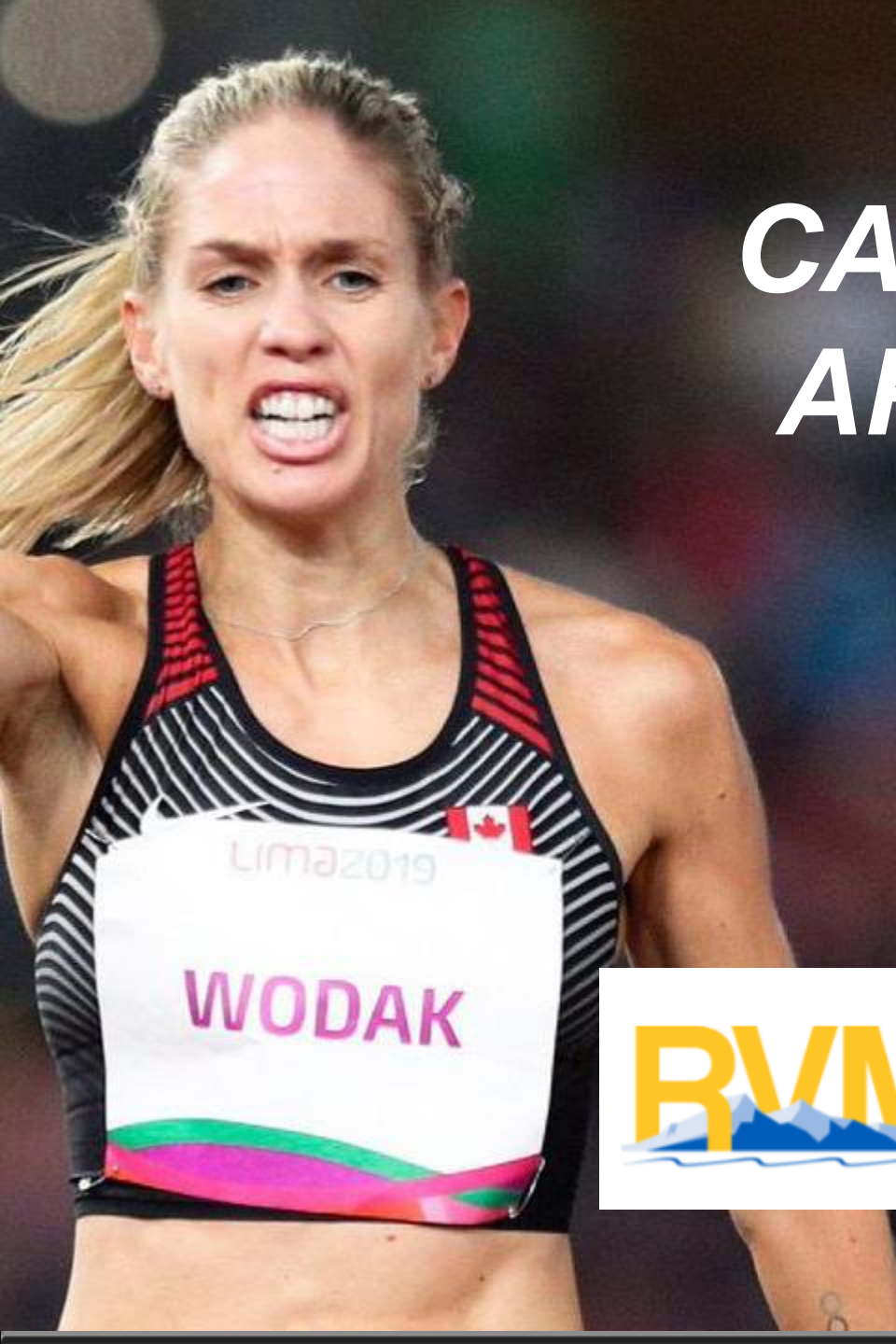
Maximizing Performance: Fueling & Hydration Strategies for Marathon and Half-Marathon



June 19th, 2023 at 7pm

Natasha Wodak, OLY
Olympian,
CDN Marathon Record Holder

Trent Stellingwerff, PhD
Canadian Sport Institute Pacific



CASE STUDY APPROACH

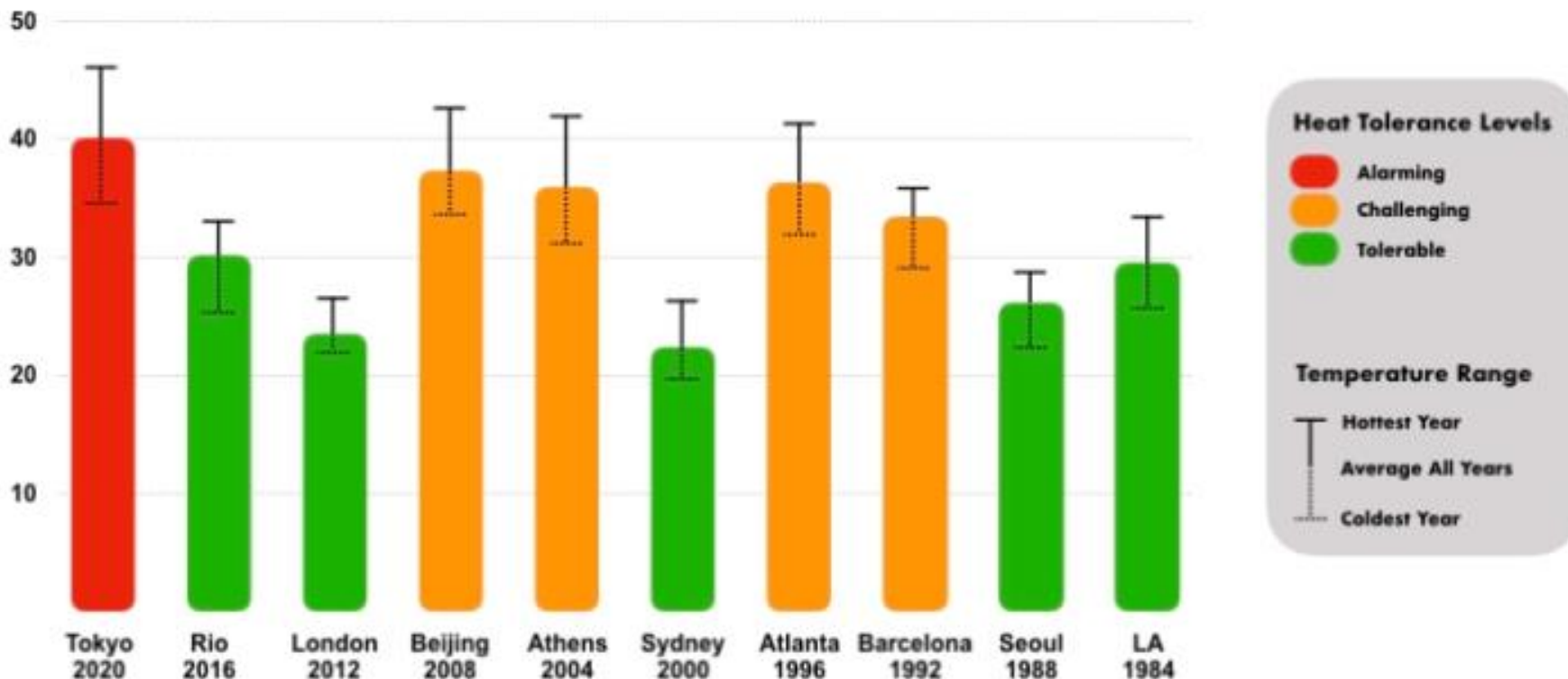
*Tokyo &
Berlin*



Projected Tokyo Weather (humidex)

OLYMPIC CITIES AND THE HEAT FACTOR

Mean maximum 'Feels Like' temperatures between 2008 and 2016 during a given Summer Olympic Games period (in °C)



Source: World Weather Online, Dataset

sportifycities.com

28 to 34 Celsius with 70 to 100% humidity!

Case study approach to Heat & Altitude 2020(1) Olympics – Athletics...it takes a village

Olympics

Gifu & Tokyo



Trent Stellingwerff, PhD

Physiology & Nutrition / Cat Herder
AC IST Lead & West Hub / CSI Pacific

Flagstaff, Gifu
& Sapporo



Gareth Sandford, PhD

Physiologist
Post-Doctorate Fellow
CSI Pacific / UBC / AC West Hub

Gifu Holding Camp



Jen Sygo, RD

Registered Dietitian
Athletics Canada East Hub

Supported Medically

Paddy McCluskey, MD – Gifu / Tokyo
Mike Koehle, MD – Gifu / Sapporo



Paralympics

Gifu Holding Camp



Cameron Gee, PhD

Physiologist, ParaSport expertise
Post-Doctorate Fellow
UBC Okanagan
Gifu & Tokyo



Patricia Roney, MSc PT

Physiotherapist
Athletics Canada Para IST Lead / AC West Hub

Gifu Holding Camp

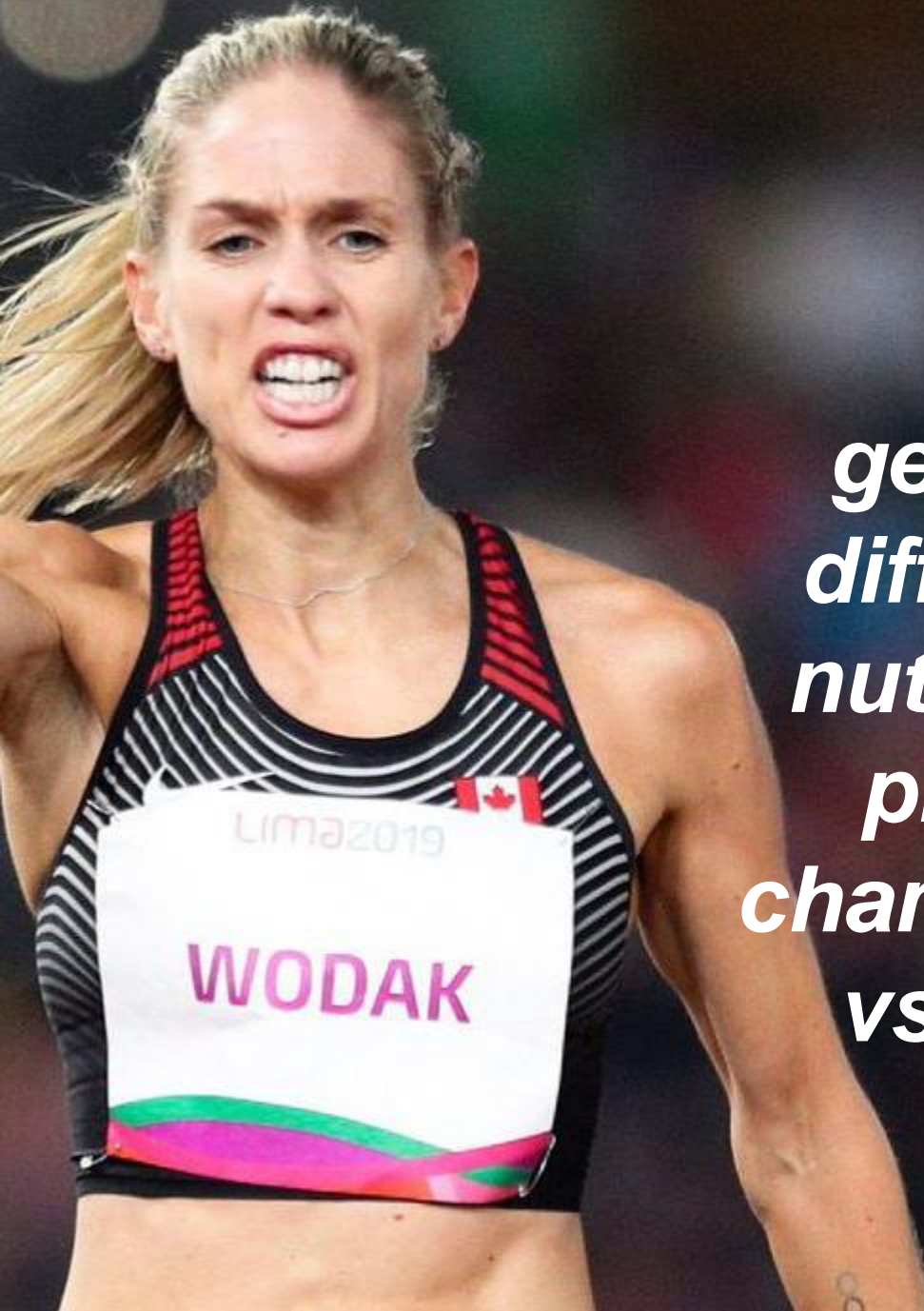


Jessalyn O'Donnell, RD

Registered Dietitian
CSI Pacific
Athletics Canada West Hub
Supported Medically
Kim Coros, MD – Gifu / Tokyo



PLUS many (>30) trusting athletes and coaches!



Q&A

What are the general (top level) differences regarding nutrition/hydration for preparing for a hot championship marathon vs. a cool marathon major?

***Sports
Nutrition can
Improve
Endurance
Performance .***



Prevalence of GI symptoms

Study, Year	Population studied	n (response rate)	Loss of appetite	Heartburn	Belching	Nausea	Vomiting
Sullivan, 1981 (205)	Recreational and competitive runners	57 (?)	5 ¹	10		6 ²	6 ²
Keefe, 1984 (100)	Marathon runners	707 (42%)					
	Hard run			10		12	2
	Easy run			9		2	0.3
	After run			4		13	2
Priebe, 1984 (154)	Runners	425 (?)					
Worobetz, 1985 (226)	Quadrathletes (swim, cycle, canoe, run)	70 (59%)	41	11	36	21	6
Sullivan, 1987 (207)	Triathletes	110 (78%)		24 ⁶	33	24 ⁷	24 ⁷
Riddoch, 1988 (175)	Marathon runners	471 (27%)	28	13		20	4
Worme, 1990 (225)	Triathletes	67 (47%)	13	9		6	
Rehrer, 1989 (164)	Runners (25 km)	44 (39%)				11	
	Marathon runners	44 (39%)				11	
Rehrer, 1992 (171)	Ultra-marathon runners	170 (?)				15	2
O'Connor, 1992 (146)	Marathon runners	22 (?)	9			9	18 ¹⁰
Lopez, 1994 (113)	Triathletes	23 ¹ 076 (90%)				4	1
Banfi, 1996 (7)	Marathon runners	13 (?)					
	During run						
	After run					31	0
						62	15

30-50% of all endurance athletes suffer from significant upper and lower GI symptoms

¹after a hard run or a race
²severe nausea or retching
³abdominal cramps or diarrhea
⁴described as bloody stools
⁵described as scant hematochezia
⁶described as gastroesophageal reflux
⁷nausea or vomiting
⁸urgency for bowel movement, diarrhea, or fecal incontinence
⁹described as incontinence
¹⁰described as stomach cramps
¹¹described as epigastralgia
¹²described as colic

de Oliveira EP, Burini RC. The impact of physical exercise on the gastrointestinal tract. Curr Opin Clin Nutr Metab Care. 2009;12(5):533-8.

Horner KM, Schubert MM, Desbrow B, Byrne NM, King NA. Acute exercise and gastric emptying: a meta-analysis and implications for appetite control. Sports Med. 2015;45(5):659-78.

de Oliveira EP, Burini RC, Jeukendrup A. Gastrointestinal complaints during exercise: prevalence, etiology, and nutritional recommendations. Sports Med. 2014;44 Suppl 1:S79-85.

Pfeiffer B, Stellingwerff T, Hodgson AB, Randell R, Pottgen K, Res P, et al. Nutritional intake and gastrointestinal problems during competitive endurance events. Med Sci Sports Exerc. 2012;44(2):344-51. (n=221)

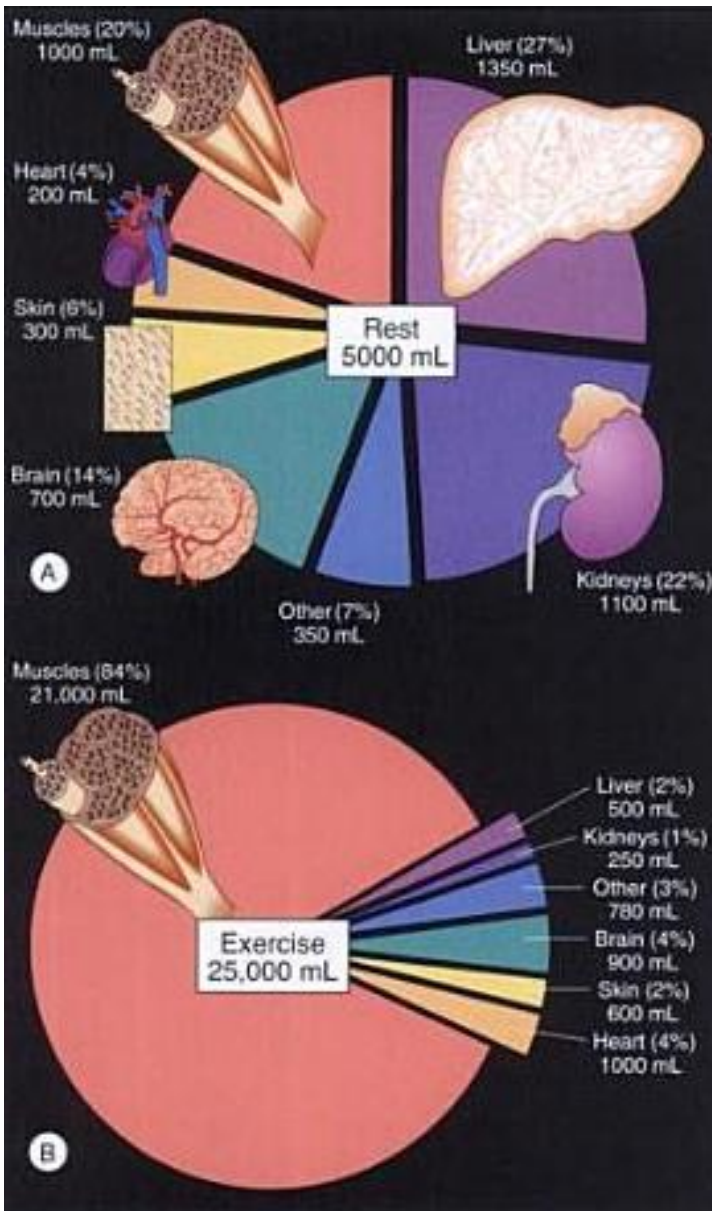
Blood shunting / Splanchnic hypo-perfusion

Gisolfi CV. Is the GI System Built For Exercise? News Physiol Sci. 2000;15:114-9.

During severe/intense exercise

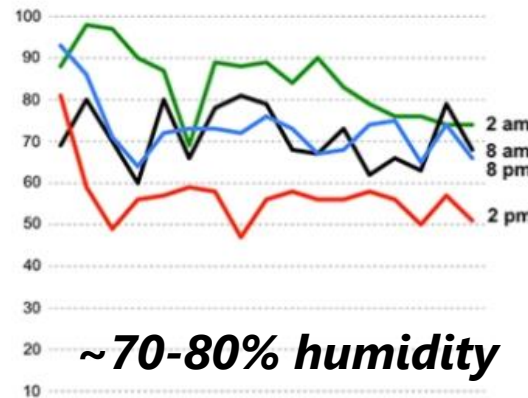
- splanchnic blood flow is markedly reduced
- intestinal permeability can increase
- comprised gut-barrier function

exercise in the heat and dehydration further impairs the gut via combined effects of ischemia, hypoxia, and hyperthermia

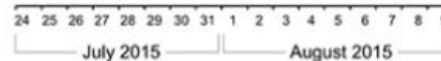
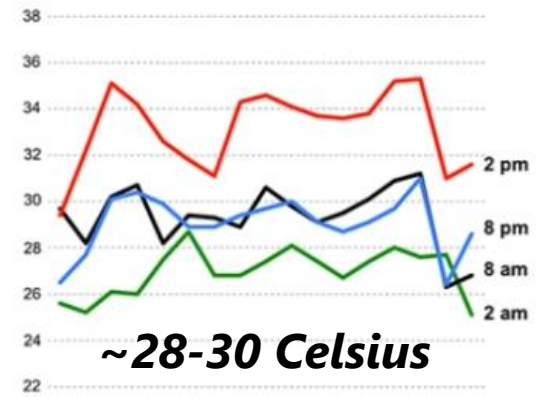


Exemplary humidity and temperature patterns during the scheduled 2020 Olympic Games period

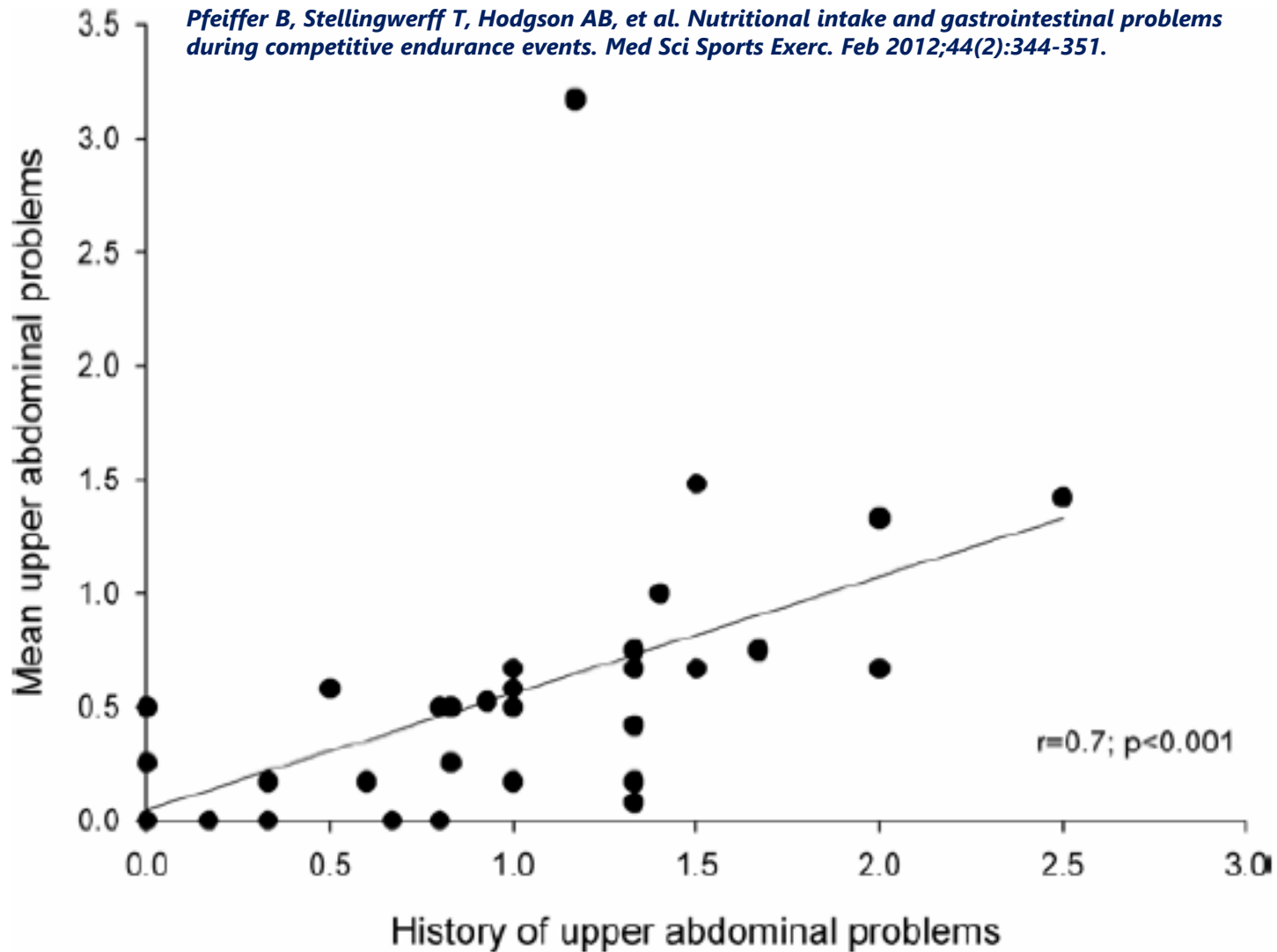
Humidity levels (in %) at 2am, 8am, 2pm and 8pm



Air temperatures (in °C) at 2am, 8am, 2pm and 8pm



GI Problems & History of GI Problems



Is dehydration and/or heat stress relevant to Athletics?

Table 1. Potential body water balance concerns for Track & Field athletes

Event	Sweat Losses ¹		Availability of Fluids		Risk of Dehydration		Performance Risk	
	Training	Competition	Training	Competition	Training	Competition	Training	Competition
Jumping (high jump, long jump, triple jump, pole vault)	MOD	LOW	HIGH	HIGH	LOW	LOW*	LOW	LOW
Throwing (shot put, javelin, discus)	MOD	LOW	HIGH	HIGH	LOW	LOW	LOW	LOW
Sprints (< 800 meters)	MOD	LOW	HIGH	HIGH	LOW	LOW	LOW	LOW
Middle Distance Running (800 meters to 10 km)	HIGH	LOW	MOD	LOW	MOD	LOW	MOD	HIGH
Long Distance Running/Walking (> 10 km)	HIGH	HIGH	LOW	LOW	HIGH	HIGH	HIGH	HIGH
Multi-Events (Decathlon)	HIGH	MOD	HIGH	HIGH	LOW	LOW	LOW	LOW

¹product of sweating rate and time; MOD = moderate; *assumes no purposeful dehydration

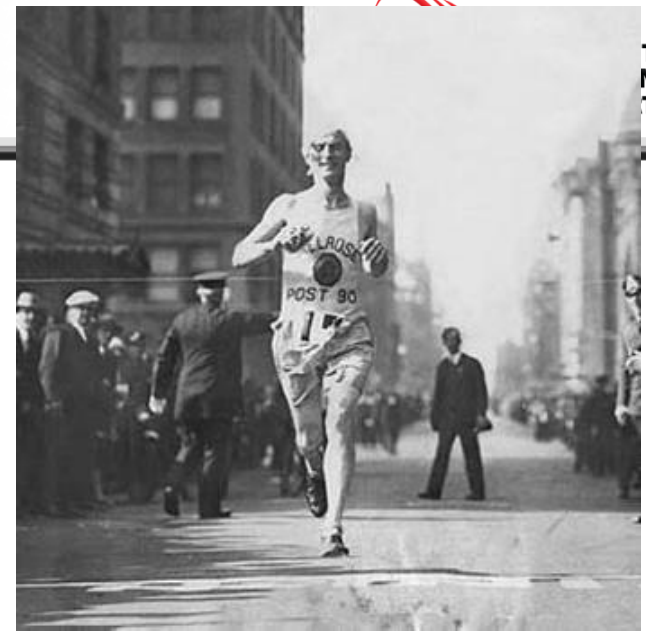
Availability of fluids during competition (or the ability to take on fluids at critical tactical times of a race) are not fully appreciated by individuals who exclusively advocate for drink to thirst.

Historical – Boston Marathon

SUGAR CONTENT OF THE BLOOD IN RUNNERS FOLLOWING A MARATHON RACE

WITH ESPECIAL REFERENCE TO THE PREVENTION
OF HYPOGLYCEMIA: FURTHER OBSERVATIONS *

JOUR. A. M. A.
Aug. 15, 1925

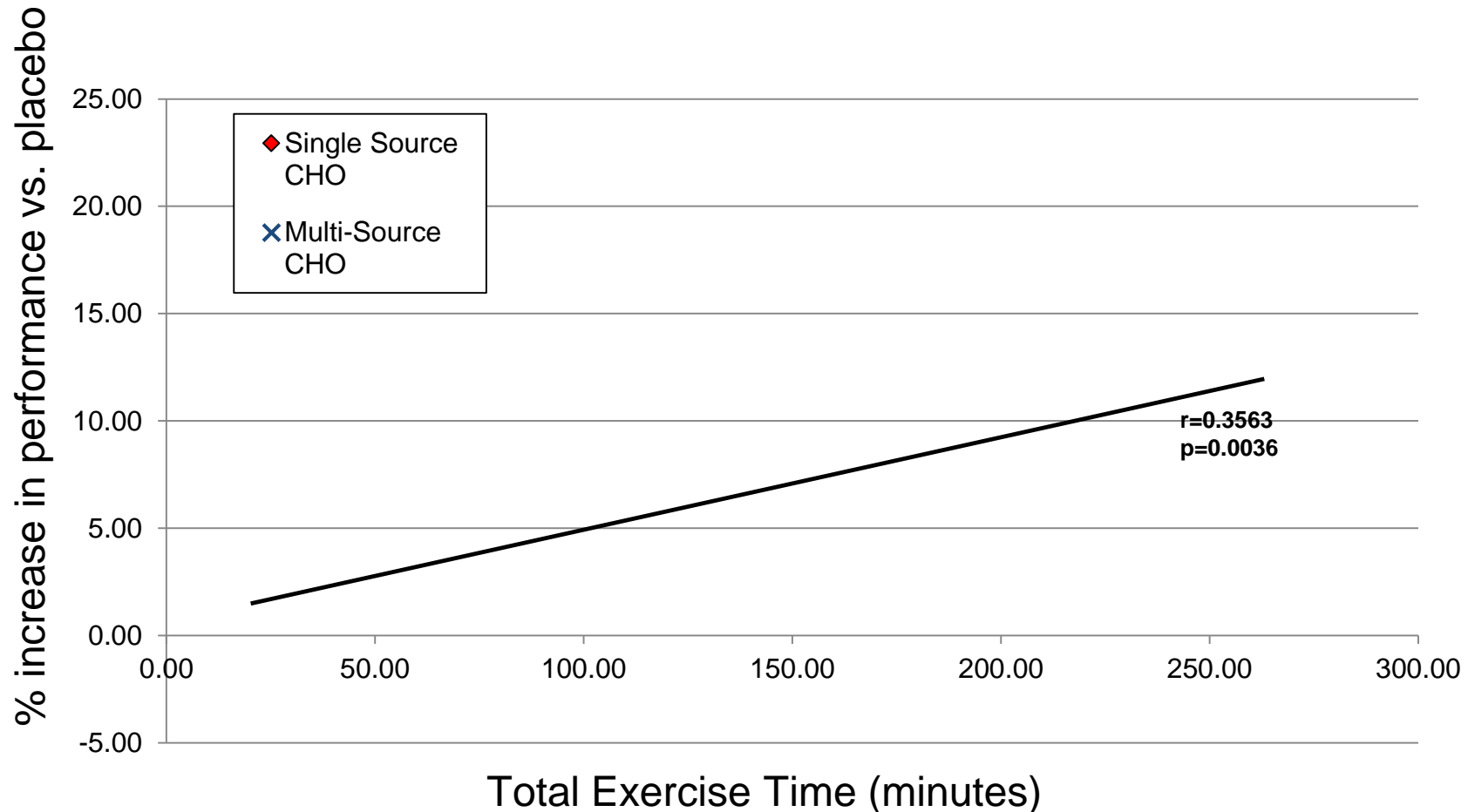


BURGESS GORDON, M.D.
L. A. KOHN, M.D.; S. A. LEVINE, M.D.
MARCEL MATTON, M.D.
W. DE. M. SCRIVER, M.D.
AND
W. B. WHITING, M.D.
BOSTON

glucose candies to be eaten from time to time while running. In addition, they were supplied with tea containing a large amount of sugar at stations along the course. The blood studies showed normal sugar levels in all runners, in contrast to the low figures obtained last year. There was also a striking improvement in their general physical condition. In a number of instances the running time was faster than in the year previous and the participants finished in better position. It seems, therefore, that the picture of exhaustion, weakness, shock and other symptoms of hypoglycemia following prolonged effort may be prevented by the adequate and timely ingestion of carbohydrate.

CHO, Exercise Duration & Performance Effects

n=38 studies / 679 subjects of CHO vs. water
using a TT with varying CHO intake rates



RISK vs. REWARD – fuel & fluids in the heat

Improved performance

Carbohydrate (CHO) ingestion during exercise has been shown to improve endurance performance

Smith et al., JAP, 2010:

For 20km TT performance after 2hrs at 77% Vo₂peak

For Performance:

60g CHO/hr > 30g/hr > 15g/hr > 0g/hr

Impaired performance

Too much carbohydrate and fluid intake may lead to gastrointestinal disorders and therefore impair performance

*ACSM recommendations are 30 to 60 g carbohydrate / hour in ~6 to 8% CHO solution

*Indications in Jeukendrup lab studies with multi-transportable carbohydrates had intake rates greater than 90g carb / hour (~12-15% CHO solutions) without any significant GI discomfort.



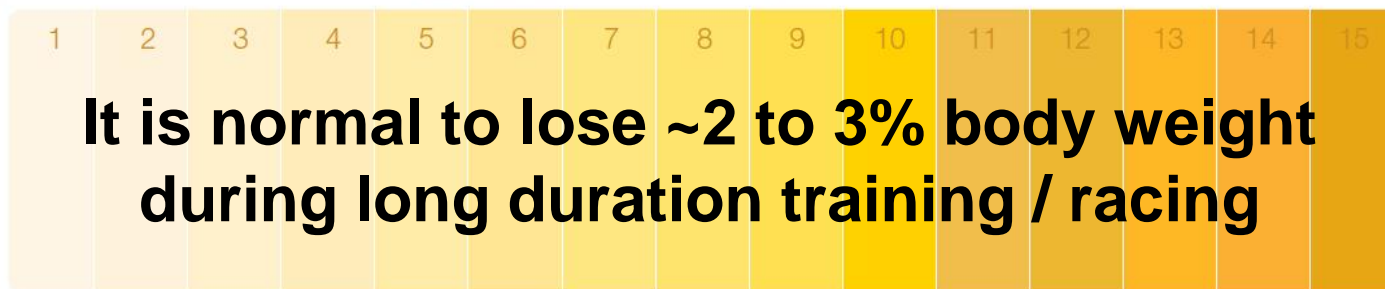
Individualize Collect data, Track & Adjust



RVM ROYAL
VICTORIA
MARATHON

LIQUID ASSETS

THE FACTS ABOUT HYDRATION FOR SUCCESS



Well hydrated dehydrated

Your urine should be plentiful and it's colour should be in the well hydrated zone. If not, start drinking immediately.

Weight loss (kg)	0.25	0.5	0.75	1	1.25	1.5	1.75	2
Volume to drink (ml)	0.25	750	1125	1500	1875	2250	2625	3000

1 L of sweat = 1 kg body weight

- Therefore, try and get a sense of individual sweat rate, in target race conditions by tracking pre to post- workout-out body weight.

Practice fueling & hydration sweat rate tracking during long runs

Sweat, Fluid and Carbohydrate Intake worksheet

CHO = carbohydrate (in grams)

Date	Temp	Humidity	Pre-Run Weight (kg)	Post-Run Weight (kg)	Amount of fluids ingested (L)	Total amount of CHO's (grms) consumed	Time run hrs or fraction of hrs	Fluid intake rate (L/hr)	CHO intake rate (CHO/hr)	Sweat Rate (L/hr)	% Body Weight Loss	Comments (feeling, GI effects etc.)
								#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Track information into spreadsheet / work tool to find out what your Individual sweat rate and fueling intake abilities are...												
								#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

- On every run longer than ~75min track sweat rate in different weather conditions, especially in targeted race weather conditions – track information into worksheet.
- Practice fueling and hydration in every long run. Practice with different amounts of fluids and fuels, mimicking the timing of intake in your race (~15 to 20min) -- track information into worksheet. Ideally practice under race pace intensities and durations!
- Aim for at least **40g of carbs/hr and >500ml/hr** water to start. But try and really “test” your GI and see what you can handle. The more you can adapt and handle taking in carbohydrate, the more fuel you will have at the end of the race. Ideally, you can adapt to hit **>60g CHO/hr or more when running and >90g CHO/hr cycling!**

Practice the RULE OF 15

~15 to 25g CHO every ~15 to 25min
into

~150 (5oz) to 200 (7oz) ml of fluids (~8-15% carb solution)

(~80 to 120g CHO per liter of fluids)

- On every run longer than ~75min track sweat rate in different weather conditions, especially in targeted race weather conditions – track information into worksheet.
- Practice fueling and hydration in every long run. Practice with different amounts of fluids and fuels, mimicking the timing of intake in your race (~15 to 20min) -- track information into worksheet. Ideally practice under race pace intensities and durations!
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Practice / Practice / Practice



From: Trent Stellingwerff <tstellingwerff@csipacific.ca>

Sent: Sunday, July 11, 2021 10:42 AM

Natasha XX kg start // XX kg end
=3.8% BW loss. Right on the upper/outer end of what we would want for a workout (2 to 4%). But, felt strong throughout, so from a hydration perspective, a great session.

Great job on that.

7:20am - Temp - 25.0 / 48%
Humidex = 28

8:30am - Temp - 27.6 . 46.5%
Humidex = 32

9:00am
27.7C . 41.1%
Humidex = 31

Workout Splits

23:46 7k

20:22 6k

17:08 5k

13:36 4K

10:16 3k

6:46 2k

3:18 1k

ctice





- Can only get ~50 to 100ml (1 to 3 swallows) per cup (the rest will usually spill out)
- That is only 3 to 6 grams of CHO per cup!
- Other options to hit fueling targets:
 - Slow down and take 2 or 3 cups per aid station
 - Augment CHO intake with gels that you carry
 - Fuel belt

Natasha Wodak – Key Fueling Workouts in RED



Date	Training BLOCK	General Training Details	
Monday, January 24, 2022	Meso Block 1 (10 day)	Day Off	
Tuesday, January 25, 2022		Easy	
Wednesday, January 26, 2022		HARD	
Thursday, January 27, 2022		Easy/Moderate	
Friday, January 28, 2022		Easy	
Saturday, January 29, 2022		VERY HARD	
Sunday, January 30, 2022		Day Off	
Monday, January 31, 2022		Easy	
Tuesday, February 1, 2022		HARD (double threshold)	
Wednesday, February 2, 2022		Easy	
Thursday, February 3, 2022	Meso Block 2 (11 day)	LONG Run /Mod	
Friday, February 4, 2022		Easy	
Saturday, February 5, 2022		VERY HARD	
Sunday, February 6, 2022		Easy/Moderate	
Monday, February 7, 2022		Easy	
Tuesday, February 8, 2022		HARD	
Wednesday, February 9, 2022		Day Off	
Thursday, February 10, 2022		Easy	
Friday, February 11, 2022		Pre-Race Tune-up (e.g. 3 x 1km at half marathon pace)	
Saturday, February 12, 2022		Easy	
Sunday, February 13, 2022		VERY HARD TBD // Vancouver Half Marathon RACE	
Monday, February 14, 2022	Meso Block 3 (10 day)	DAY OFF // Travel to Chula Vista for AC Training Camp (Block 1)	
Tuesday, February 15, 2022		Easy	Chula Vista Training Camp with AC
Wednesday, February 16, 2022		Easy	
Thursday, February 17, 2022		HARD (double threshold)	
Friday, February 18, 2022		Easy	
Saturday, February 19, 2022		LONG Run /Mod	
Sunday, February 20, 2022		Easy	
Monday, February 21, 2022		VERY HARD	
Tuesday, February 22, 2022		Day Off / Travel home to Van from Chula	
Wednesday, February 23, 2022		Easy	
Thursday, February 24, 2022	[10 day]	HARD (double threshold)	
Friday, February 25, 2022		Easy	
Saturday, February 26, 2022		Easy	
Sunday, February 27, 2022		LONG Run /Mod	

What type of sports drink?



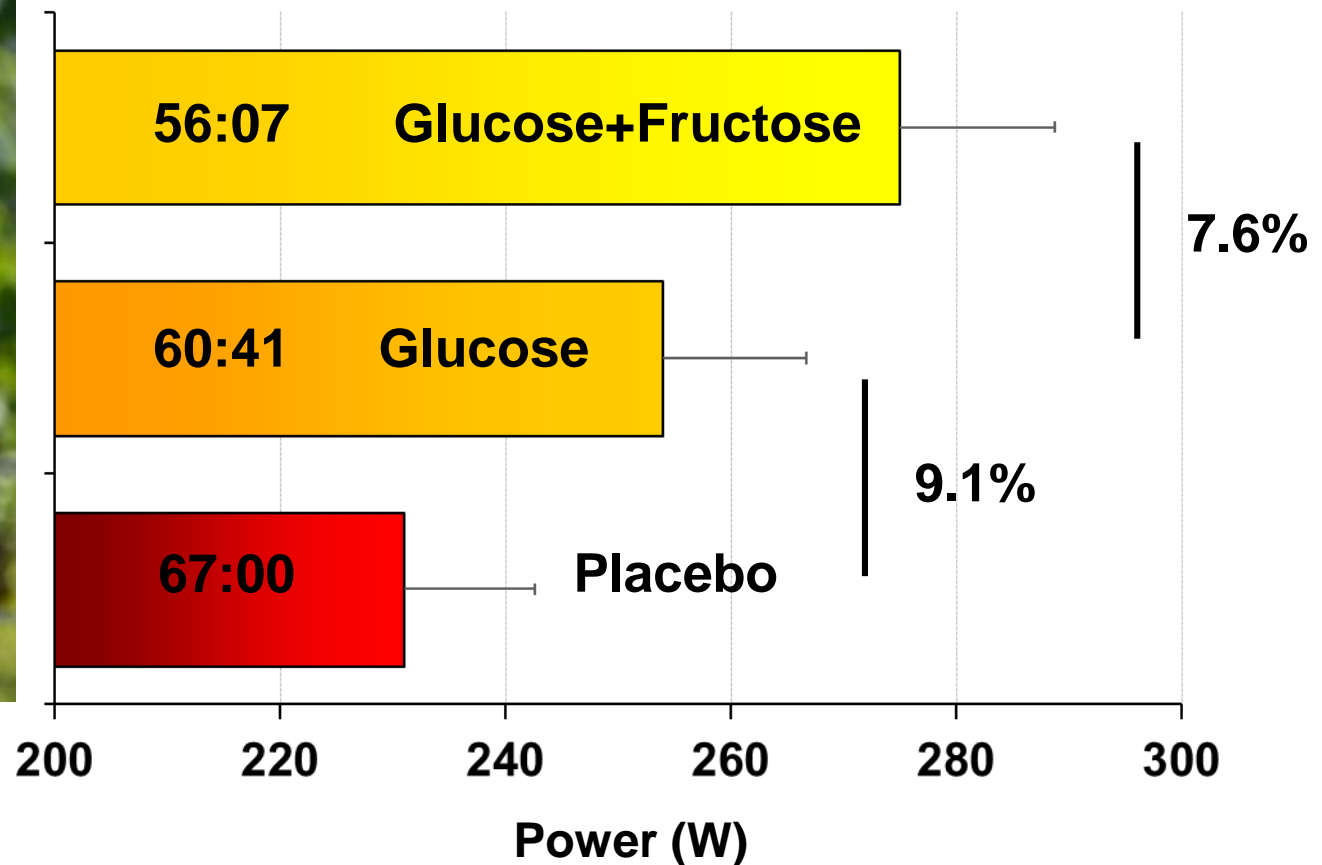
- Carbohydrate concentration of ~ 5 to 12% (ideally ~6 to 8% on hot days, more concentrated on cool days and with glucose:fructose blends)
- Ideally a carbohydrate blend of **glucose:fructose** (or maltodextrin & fructose. Note: order of ingredient list indicates largest ingredient.)
- A sports drink or gel you have practiced with and have adapted to
- Ideally the same sports drink is available on race day, or accessible in race location
- A sports drink that, after practicing, still tastes good (no flavour fatigue)

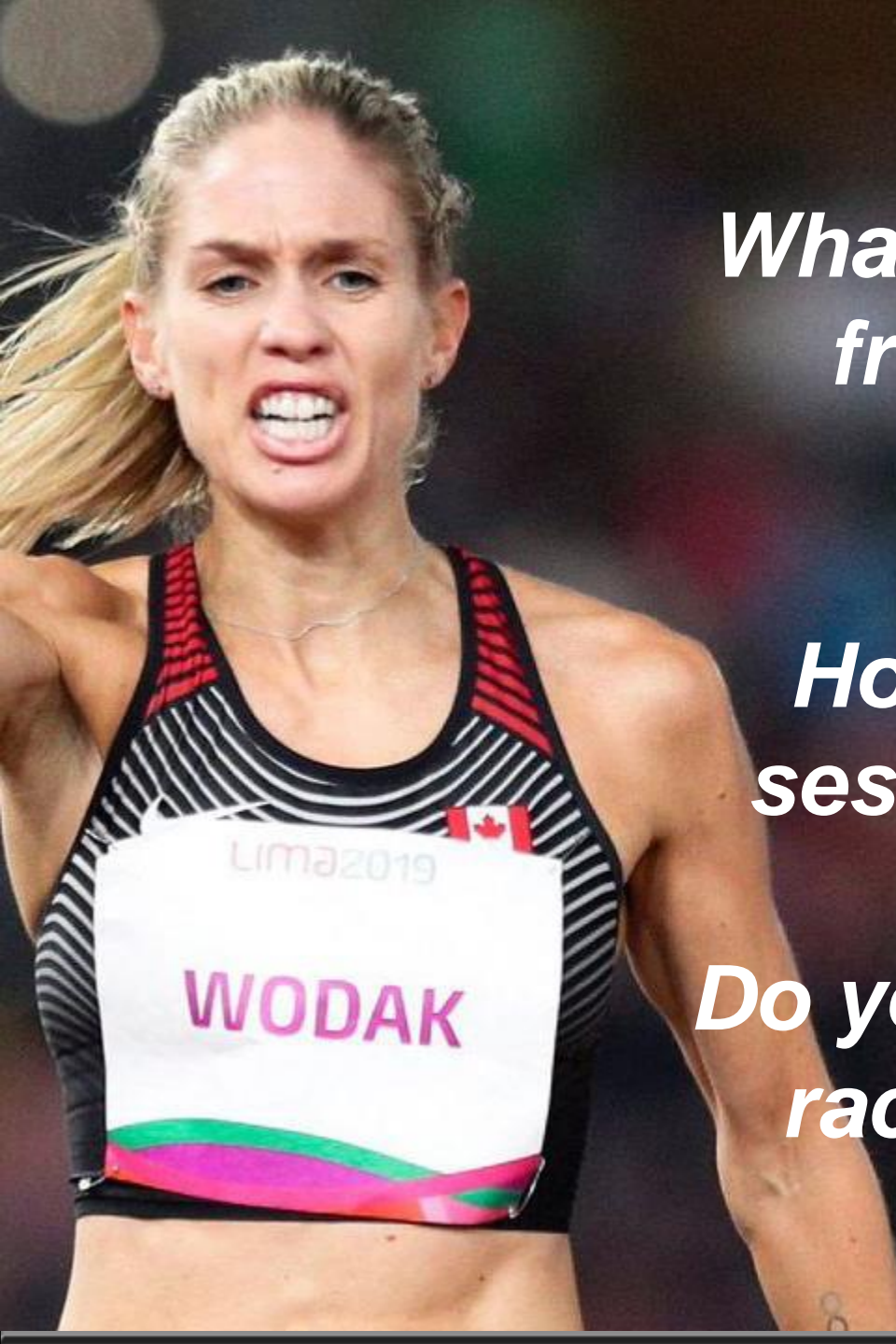
Performance with glucose+fructose versus glucose

Currell and Jeukendrup. Med Sci Sports Exerc 40(2): 275–281, 2008



2h at 60%VO₂max followed by a 1h time trial (~40 km)





Q&A

What have you learned from these practice sessions?

How many practice sessions do you need?

Do you mimic the entire race day (get up early too?)

*Understand and try to
implement & practice
every element of the event
/ course / stadium
(timing, logistics, course, rules,
projected weather)*



Sapporo Course Details - Marathon



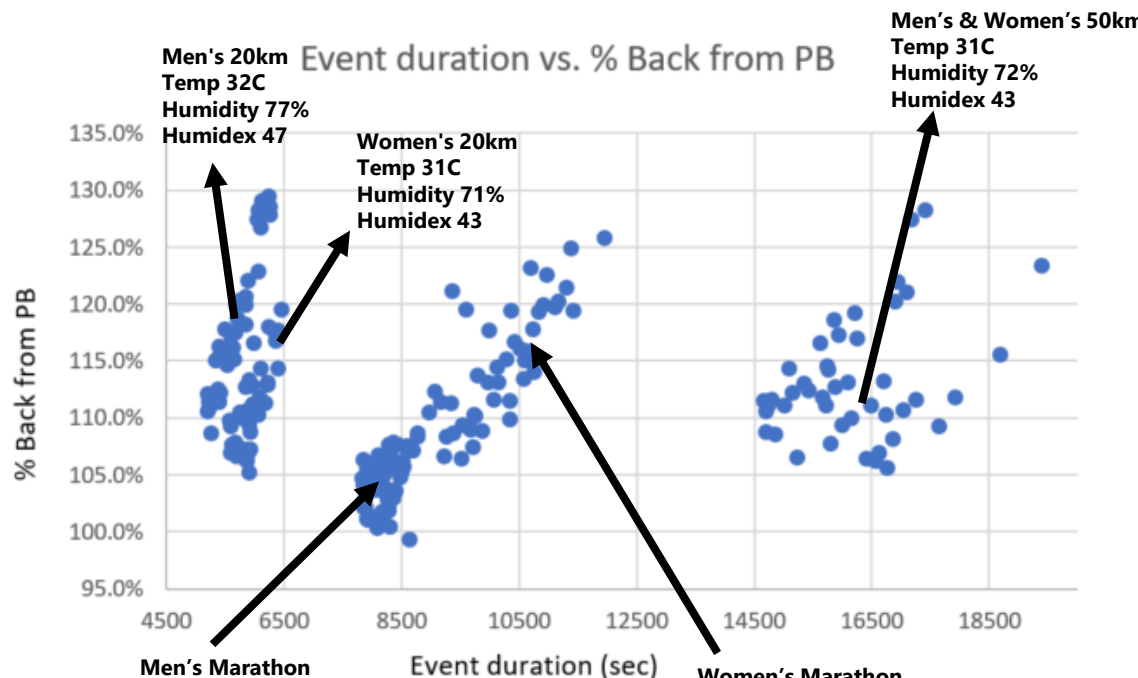
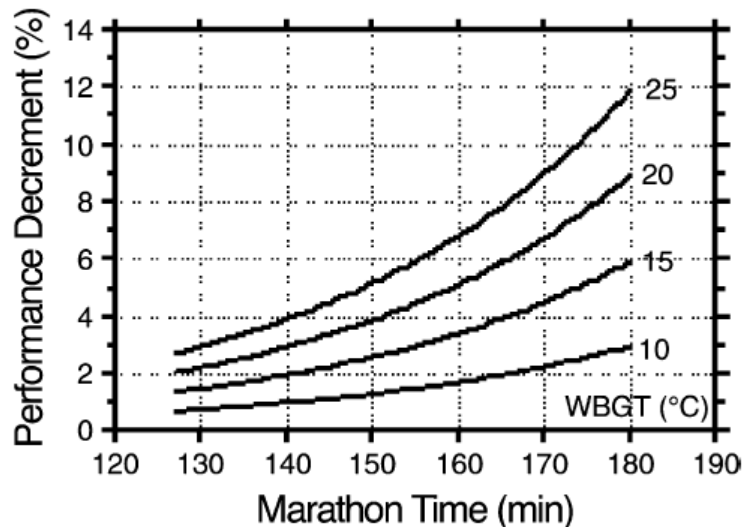
Sapporo Challenge Half Marathon 2021 (Olympic Test Event)

STATION	KM	GAP
1.	4.8	4.8 km
2.	8.5	3.7 km
3.	13.2	4.7 km
4.	16.3	3.1 km
5.	20.1	3.8 km
6.	23.2	3.1 km
7.	26.3	3.1 km
8.	30.1	3.8 km
9.	33.1	2.0 km
10.	36.2	3.1 km
11.	40.1	3.9 km

- Typical Temps / winds humidity at race time?
- Location of aid tables (left or right handed? / off tangent?)
- Location of personal aid tables?
- Staff location / permissions required accreditations?
- Access to water, ice, ice tubs?
- Pre-event change tents – location / air conditioned?
- Medical support / type?

Race execution – PACING ADJUSTMENTS!!!

Internal analytics



The common factor among fast performances has been low Tdb (10.6–12.8-C (M); 11.6–13.6-C (F)). The presence of cloud cover or low solar load does not increase the likelihood of running a fast marathon.

Ely, M.R., et al., *Impact of weather on marathon-running performance. Medicine and science in sports and exercise*, 2007. 39(3): p. 487-93.

Ely, M.R., et al., *Effect of ambient temperature on marathon pacing is dependent on runner ability. Medicine and science in sports and exercise*, 2008. 40(9): p. 1675-80.

POS	FIN	ATHLETE	COUNTRY	MASS	MASS2	MASS3	FIN	PB	FIN	MASS	% of PB	% of MA	% of MA2	% of MA3	Temp	Humidity	Humidex
1		Ruth CHOPINETSCH	KEN	2:32:42	2:33:43	9563	2:17:06	8228	2:17:06	9216	111.4%	115.0%	111.4%	115.0%	32	74	46
2		Rose CHELIMO	BRN	2:33:46	2:33:46	9226	2:24:14	8654	2:30:35	9015	106.0%	110.3%	102.1%	113.3%	32	74	46
3		Hestilla JOHANNES	NAM	2:34:15	2:34:15	9255	2:22:25	8545	2:22:25	8545	108.3%	11.83	108.3%	11.83	32	74	46
4		Edna Ngeirongony KIRAGAT	KEN	2:35:58	2:35:56	9336	2:15:50	8390			111.3%	15.77		32	74	46	
5		Volha MAZURONAK	BLR	2:36:21	2:36:21	9381	2:23:54	8634	2:26:13	8773	108.7%	12.45	106.9%	10.13	32	74	46
6		Roberta GRÖNER	USA	2:38:44	2:38:44	9524	2:29:09	8949	2:29:09	8949	106.4%	9.58	106.4%	9.58	32	74	46
7		Mitsuki TANIMOTO	JPN	2:39:09	2:39:09	9548	2:21:28	8728	2:26:28	8728	105.4%	13.68	105.4%	13.68	32	74	46
8		Ji Hyang KIM	PRK	2:41:04	2:41:24	9664	2:28:06	8886	2:28:35	8915	109.0%	13.30	106.0%	12.82	32	74	46
9		Lyndsey TESSIER	CAN	2:42:03	2:42:03	9723	2:30:47	9047			107.5%	11.27		32	74	46	
10		Lin QI	PRK	2:42:23	2:42:23	9743	2:27:12	8832	2:27:12	8832	110.1%	15.18	110.1%	15.18	32	74	46
11		Macka NAKANO	JPN	2:42:39	2:42:39	9799	2:27:39	8859	2:27:39	8859	110.2%	15.00	110.2%	15.00	32	74	46
12		Desi Jisa MOKONIN	BRN	2:43:19	2:43:19	9799	2:23:39	8619	2:23:44	8624	113.7%	19.67	113.0%	19.58	32	74	46
13		Carrie DIMOFF	USA	2:44:58	2:44:58	9875	2:31:12	9072			108.9%	18.38		32	74	46	
14		Kwang-Oh RI	PRK	2:46:16	2:46:16	9976	2:26:58	8838	2:26:58	8838	113.1%	19.30	113.1%	19.30	32	74	46
15		Vasilina JEPKESHO	KEN	2:46:38	2:46:38	9998	2:21:37	8497	2:22:58	8578	117.7%	25.02	116.8%	23.67	32	74	46
16		Marta GALIMANY	ESP	2:47:45	2:47:45	10065	2:30:15	9015	2:30:15	9015	113.0%	17.50	113.0%	17.50	32	74	46
17		Nastassja IVANOVA	BLR	2:48:41	2:48:41	10111	2:27:54	8844	2:30:30	9210	114.4%	21.38	109.9%	21.38	32	74	46
18		Charlotte FOUGBERG	SWE	2:49:17	2:49:17	10157	2:29:40	8980	2:29:40	8980	113.1%	19.62	113.1%	19.62	32	74	46
19		Anne-Mari HIRVILÄINEN	FIN	2:51:28	2:51:28	10286	2:28:53	8931	2:30:04	9304	115.1%	22.55	109.6%	16.37	32	74	46
20		Mariela JOSEVA	CZE	2:52:22	2:52:22	10442	2:28:53	9413	2:30:53	9413	109.9%	15.48	109.9%	15.48	32	74	46
21		Rutendo Joan NYAHORA	ZIM	2:52:33	2:52:33	10333	2:34:49	9289	2:34:49	9289	111.5%	17.73	111.5%	17.73	32	74	46
22		Sardana TROFIMOVA	ANA	2:52:46	2:52:46	10366	2:24:38	8678	2:31:31	9091	119.5%	28.13	114.0%	21.25	32	74	46
23		Nahve WELDI	ERI	2:53:40	2:53:40	10425	2:28:57	8937	2:28:57	8937	116.6%	24.80	114.6%	24.80	32	74	46
24		Yugui MA	CHN	2:55:24	2:55:24	10524	2:31:06	9066	2:31:06	9066	116.1%	24.30	116.1%	24.30	32	74	46
25		Khushigalkhan GALBADRACH	MGL	2:56:15	2:56:15	10575	2:35:27	9327	2:35:27	9327	113.4%	20.80	113.4%	20.80	32	74	46
26		Alexa VIANO	FIN	2:56:50	2:56:50	10590	2:32:24	9204			115.1%	23.10		32	74	46	
27		Melanie MYRAND	CAN	2:57:40	2:57:40	10660	2:33:20	9200	2:33:20	9200	115.9%	24.33	115.9%	24.33	32	74	46
28		Salomé ROCHA	POR	2:58:19	2:58:19	10699	2:24:47	8687	2:24:47	8687	123.2%	33.53	123.2%	33.53	32	74	46
29		Olivera PRIVILEZIO	GRE	2:58:43	2:58:43	10723	2:35:31	9311	2:35:31	9311	114.9%	23.20	114.9%	23.20	32	74	46
30		Valdineia DOS SANTOS SILVA	BRA	2:59:00	2:59:00	10740	2:32:01	9121	2:34:12	9252	117.8%	26.08	116.1%	24.80	32	74	46
31		Manuela SOCCOL	BLR	2:59:11	2:59:11	10751	2:37:09	9429	2:40:09	9605	114.0%	22.03	113.9%	19.10	32	74	46
32		Svetlana KUCHELICH	BLR	3:00:38	3:00:38	10838	2:31:20	9080	2:31:20	9080	119.4%	29.30	119.4%	29.30	32	74	46
33		Cuomi CHEN	CHN	3:01:56	3:01:56	10916	2:31:42	9102	2:31:42	9102	119.9%	30.23	119.9%	30.23	32	74	46
34		Munkhaya BAYARTOGOT	MGL	3:02:57	3:02:57	10977	2:29:18	8958	2:29:18	8958	122.5%	33.65	122.5%	33.65	32	74	46
35		Rochelle RODRIGES	AUS	3:03:12	3:03:12	11112	2:34:45	9285	2:34:45	9285	119.7%	30.45	119.7%	30.45	32	74	46
36		Andrea HESSEL	BRA	3:06:13	3:06:13	11173	2:34:55	9295	2:34:55	9295	120.2%	31.30	120.2%	31.30	32	74	46
37		Johanna BÄCKLUND	SWE	3:08:30	3:08:30	11310	2:35:10	9310	2:35:10	9310	121.5%	33.33	121.5%	33.33	32	74	46

Race execution – PACING ADJUSTMENTS!!!

		Delay (mm:ss)																				Performance		
																						<i>largest impact</i>		
Personal best (hh:mm)	3:00	6:28	5:10	4:02	3:01	2:10	1:27	0:52	0:26	0:09	0:00	0:00	0:08	0:25	0:51	1:25	2:07	2:59	3:58	5:07	6:24	7:49	9:23	no impact
	2:55	6:17	5:02	3:55	2:56	2:06	1:24	0:51	0:26	0:09	0:00	0:00	0:08	0:25	0:49	1:22	2:04	2:54	3:52	4:58	6:13	7:36	9:08	
	2:50	6:06	4:53	3:48	2:51	2:03	1:22	0:49	0:25	0:08	0:00	0:00	0:08	0:24	0:48	1:20	2:00	2:49	3:45	4:50	6:02	7:23	8:52	
	2:45	5:56	4:45	3:42	2:46	1:59	1:20	0:48	0:24	0:08	0:00	0:00	0:08	0:23	0:47	1:18	1:57	2:44	3:39	4:41	5:52	7:10	8:36	
	2:40	5:45	4:36	3:35	2:41	1:55	1:17	0:46	0:23	0:08	0:00	0:00	0:07	0:22	0:45	1:15	1:53	2:39	3:32	4:33	5:41	6:57	8:21	
	2:35	5:34	4:27	3:28	2:36	1:52	1:15	0:45	0:23	0:08	0:00	0:00	0:07	0:22	0:44	1:13	1:50	2:34	3:25	4:24	5:30	6:44	8:05	
	2:30	5:23	4:19	3:21	2:31	1:48	1:12	0:44	0:22	0:07	0:00	0:00	0:07	0:21	0:42	1:11	1:46	2:29	3:19	4:16	5:20	6:31	7:49	
	2:25	5:12	4:10	3:15	2:26	1:45	1:10	0:42	0:21	0:07	0:00	0:00	0:07	0:20	0:41	1:08	1:43	2:24	3:12	4:07	5:09	6:18	7:34	
	2:20	5:02	4:01	3:08	2:21	1:41	1:07	0:41	0:20	0:07	0:00	0:00	0:06	0:20	0:39	1:06	1:39	2:19	3:05	3:59	4:58	6:05	7:18	
	2:15	4:51	3:53	3:01	2:16	1:37	1:05	0:39	0:20	0:07	0:00	0:00	0:06	0:19	0:38	1:04	1:36	2:14	2:59	3:50	4:48	5:52	7:02	
	2:10	4:40	3:44	2:55	2:11	1:34	1:03	0:38	0:19	0:06	0:00	0:00	0:06	0:18	0:37	1:01	1:32	2:09	2:52	3:42	4:37	5:39	6:47	
	2:05	4:29	3:36	2:48	2:06	1:30	1:00	0:36	0:18	0:06	0:00	0:00	0:06	0:18	0:35	0:59	1:29	2:04	2:46	3:33	4:27	5:26	6:31	
	2:00	4:19	3:27	2:41	2:01	1:27	0:58	0:35	0:18	0:06	0:00	0:00	0:06	0:17	0:34	0:57	1:25	1:59	2:39	3:25	4:16	5:13	6:16	
	1:55	4:08	3:18	2:34	1:56	1:23	0:55	0:33	0:17	0:06	0:00	0:00	0:05	0:16	0:32	0:54	1:21	1:54	2:32	3:16	4:05	4:60	5:60	
1:50	3:57	3:10	2:28	1:51	1:19	0:53	0:32	0:16	0:05	0:00	0:00	0:05	0:15	0:31	0:52	1:18	1:49	2:26	3:08	3:55	4:47	5:44		
Air temperature (°C)	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34		
Heat index (°C)	-11	-8	-6	-4	-2	1	3	5	7	9	10	14	16	18	20	22	24	26	29	31	33	35		
Simplified WBGT (°C)	-3	-1	1	3	4	6	8	9	11	13	14	16	18	19	21	23	24	26	28	29	31	33		
WBGT (°C)	-10	-8	-6	-4	-2	0	2	4	5	7	11	13	14	16	18	20	22	24	26	28	30	32		

Summary



Huge amount of pre-prep



Success?



What led to nearly 30% of runners pulling out of Tokyo Olympic men's marathon?

August 10, 2021 (Mainichi Japan)

Japanese version



Athletes are seen cooling themselves with ice and water while running at around the 15-kilometer mark during the men's marathon at the Tokyo Olympic Games in Sapporo on Aug. 8, 2021. (Pool photo)

TOKYO -- Thirty of the 106 competitors in the Tokyo Olympic men's marathon on the Games' final day pulled out of the race. The event started and ended at Sapporo Odori Park in Japan's northernmost prefecture of Hokkaido -- a relocation from Tokyo meant to beat the heat and where, despite concerns, temperatures did not reach 30 degrees Celsius during the race. So why were so many runners unable to finish?



The interventions seemed to help. Athletics Canada had 27 endurance athletes, that resulted in 2 medals and >50% finishing in the top 16 (6 athletes top 8), and 9 road based athletes started and 9 finished (and no major heat related medical issues)! Overall Athletics Canada had their most successful Games since the 1930's.

Malindi and Natasha were 9th and 13th, respectively.

Thank you!



Questions?