AZ EDZÉSELMÉLET ALAPJAI
Edző továbbképző konferencia

A külső és a belső terhelés specializációi és a terhelés mértékének meghatározása különböző sportágakban

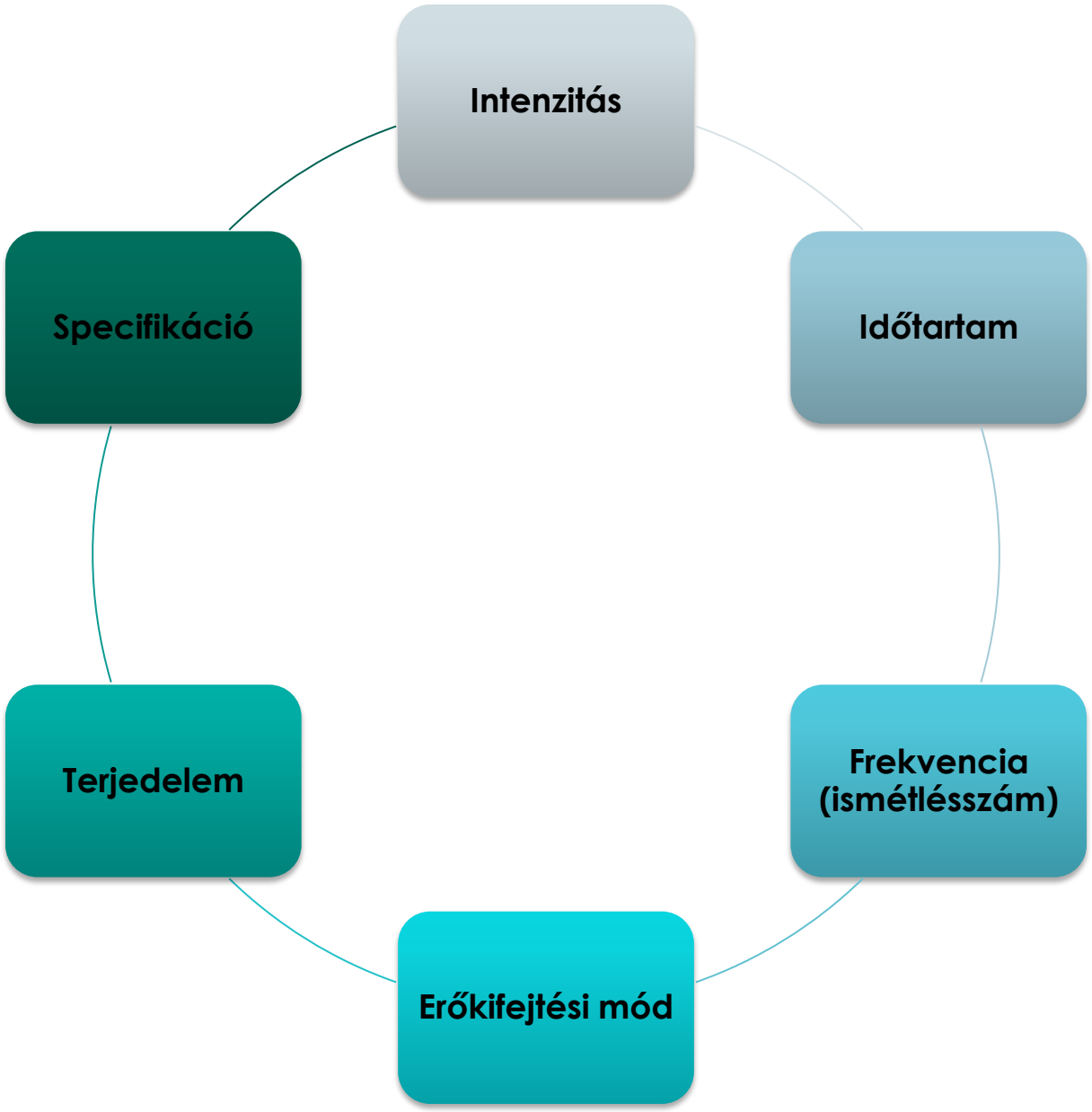
2018. június 12.

Dr. Sáfár Sándor PhD.

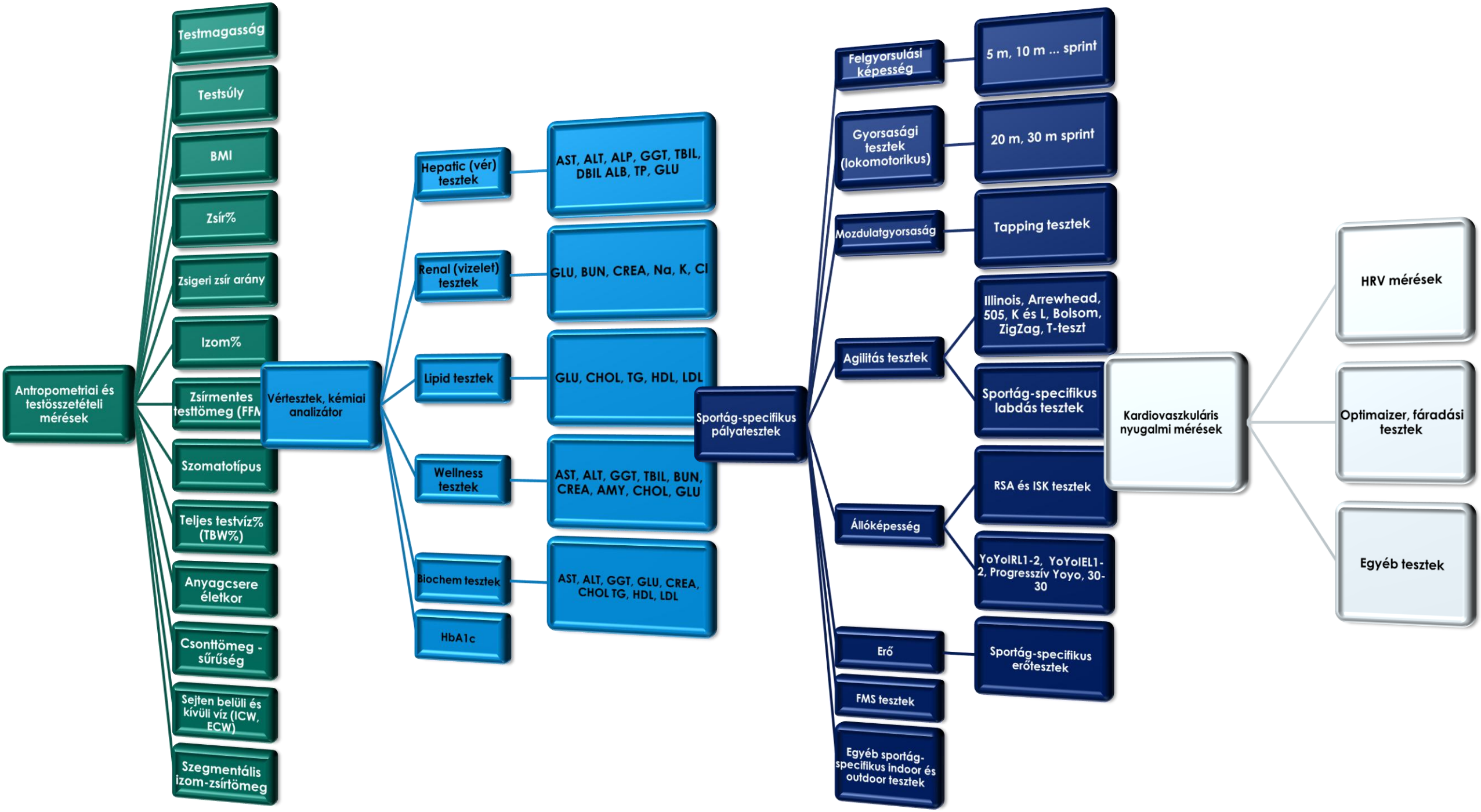
egyetemi adjunktus

MAGYAR SPORT HÁZA

A periodizációs mintát alkotó főbb terhelési összetevők



Hoover és mtsai (2015)


Antropometriai és testösszetételi mérések
Testmagasság
Testsúly
BMI
Zsír%
Zsigeri zsír arány
Izom%
Zsírmentes testtömeg (FFM
Szomatotípus
Teljes testvíz% (TBW%)
Anyagcsere életkor
Csonttömeg - sűrűség
Sejten belüli és kívüli víz (ICW, ECW)
Szegmentális izom-zsírtömeg
Vértesztek, kémiai analizátor
Hepatic (vér) tesztek
AST, ALT, ALP, GGT, TBIL, DBIL ALB, TP, GLU
Renal (vizelet) tesztek
GLU, BUN, CREA, Na, K, Cl
Lipid tesztek
GLU, CHOL, TG, HDL, LDL
Wellness tesztek
AST, ALT, GGT, TBIL, BUN, CREA, AMY, CHOL, GLU
Biochem tesztek
AST, ALT, GGT, GLU, CREA, CHOL TG, HDL, LDL
HbA1c
Sportág-specifikus pályatesztek
Felgyorsulási képesség
5 m, 10 m ... sprint
Gyorsasági tesztek (lokomotorikus)
20 m, 30 m sprint
Mozdulatgyorsaság
Tapping tesztek
Agilitás tesztek
Illinois, Arrewhead, 505, K és L, Bolsom, ZigZag, T-teszt
Sportág-specifikus labdás tesztek
Állóképesség
RSA és ISK tesztek
YoYoIRL1-2, YoYoIEL1-2, Progresszív Yoyo, 30-30
Erő
Sportág-specifikus erőtesztek
FMS tesztek
Egyéb sportág-specifikus indoor és outdoor tesztek
Kardiovaszkuláris nyugalmi mérések
HRV mérések
Optimaizer, fáradási tesztek
Egyéb tesztek

Non-kontakt sérülések a labdarúgó világbajnokság alatt (FIFA 2014)

Table 2 Top five most importantly perceived intrinsic and extrinsic non-contact injury risk factors according to physicians of 32 national teams

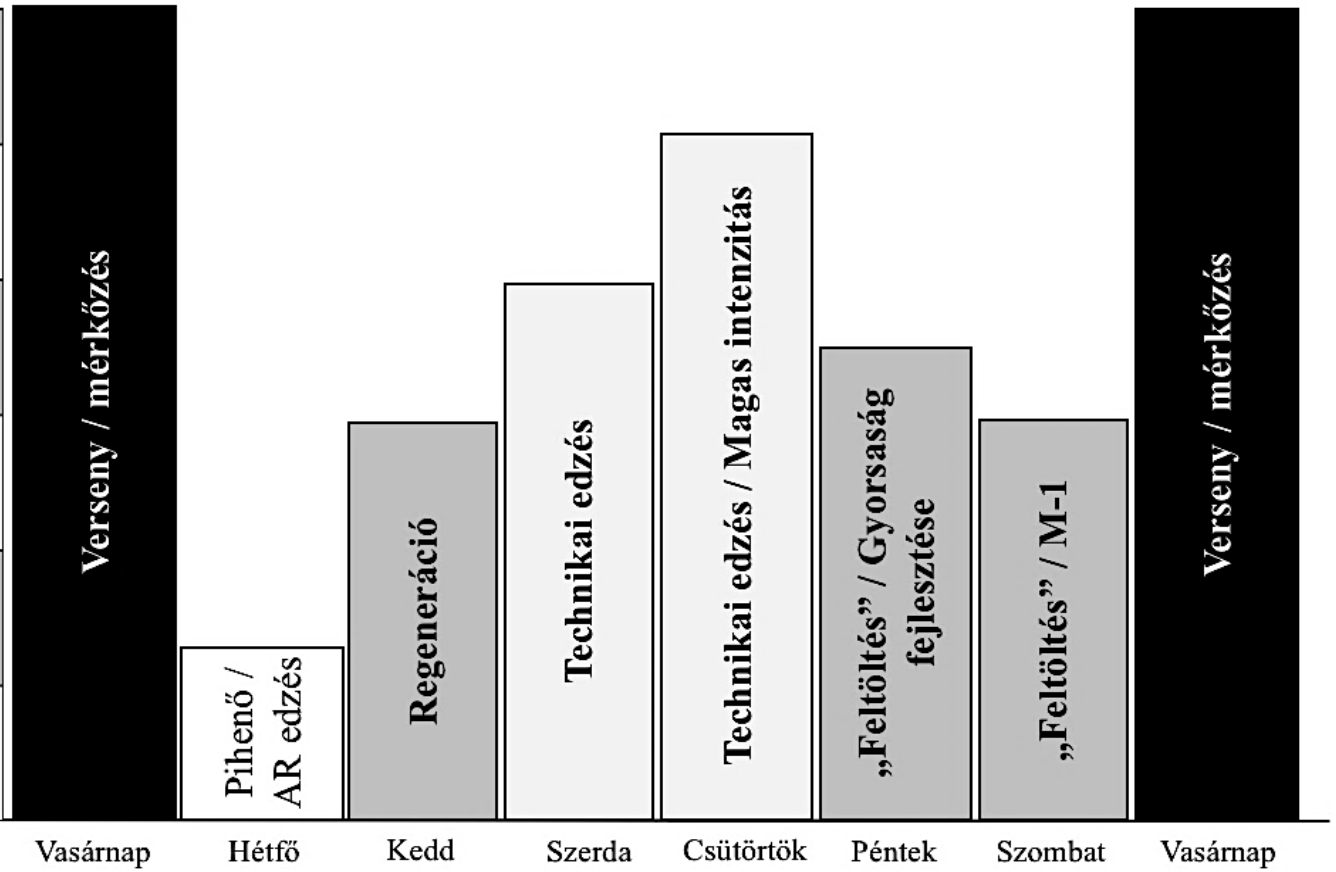
Rank	Intrinsic Risk Factor	Accumulated points of importance
1st	Previous Injury	85
2nd	Accumulated fatigue (i.e. throughout season / congested fixtures)	77
3rd	Muscle imbalance (Agonist:Antagonist)	76
4th	Physical fitness	70
5th	Balance / coordination	69

Rank	Extrinsic Risk Factor	Accumulated points of importance
1st	Reduced recovery time between matches	76
2nd	Training load in clubs prior to the World Cup	73
Joint 3rd	Training load during World Cup Congested match schedule	66
Joint 4th	Number of matches played during club season Poor pitch quality	65
5th	Recovery facilities	64

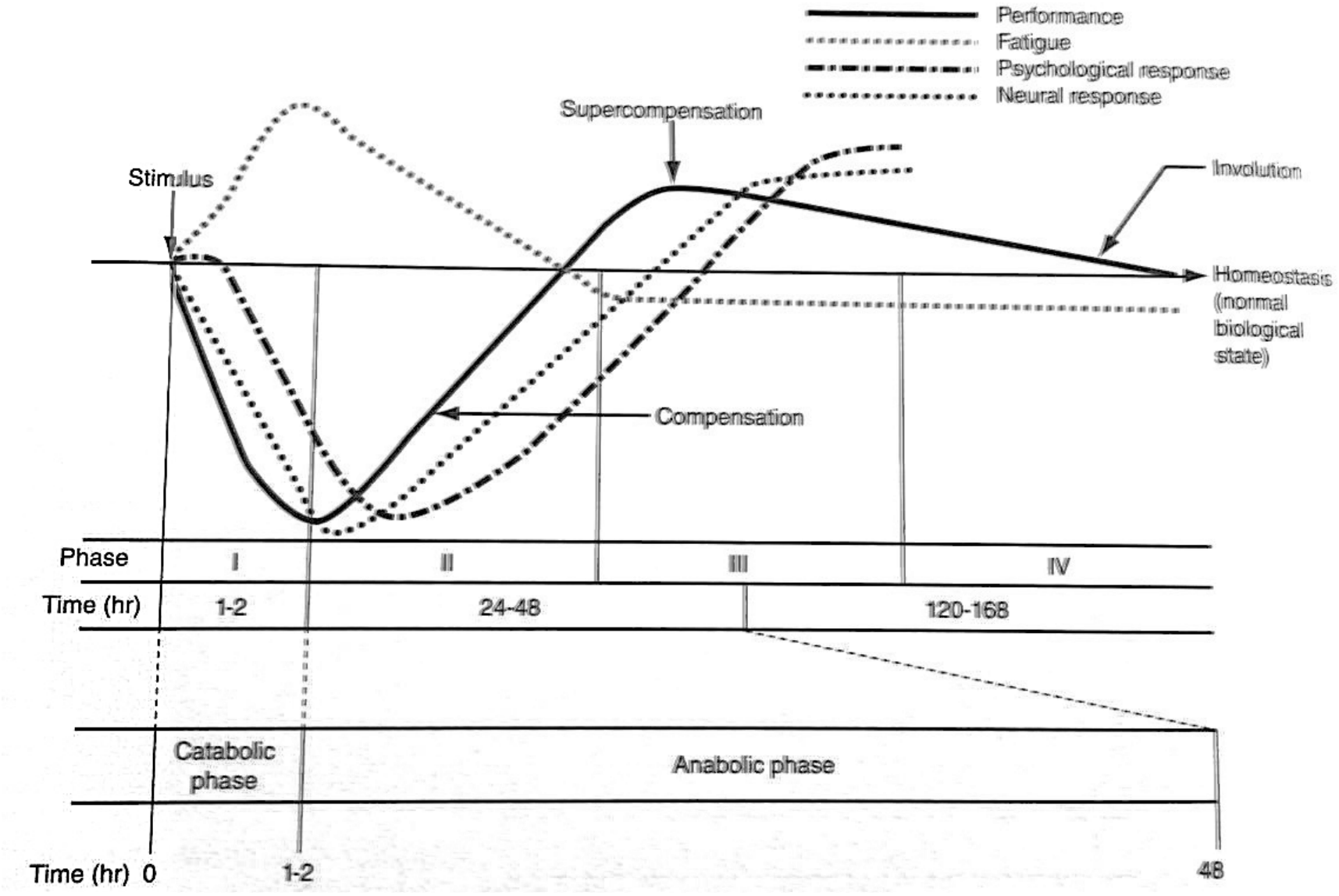
McCall és mtsai (2015)

Terhelés adagolása a mikrociklus különböző napjain, ha egy mérkőzés van a mikrociklusban (Bompa és Haff (2009) nyomán)

90-100 %	Nagyon magas
80-90 %	Magas
70-80 %	Közepes
50-70 %	Alacsony
50 % alatt	Nagyon alacsony
0	Regeneráció



Egy edzés terhelésének szerkezeti elemei, a szuperkompenzáció bázisa



beddit

Designed to keep your bedroom zen

1

Hidden under your sheet

Nothing to wear, works in any bed

2

Automatic & accurate tracking

Just sleep, with 1 or 2 people in bed

3

Extremely thin, flat & soft

Unnoticeable during sleep (0.06in/1.5mm)

4

USB power adapter

Nothing to charge, always ready

5

Ambient noise awareness

Find out if you are snoring

6

Smart alarm clock

Wake up refreshed at the right time

7

Temperature & humidity

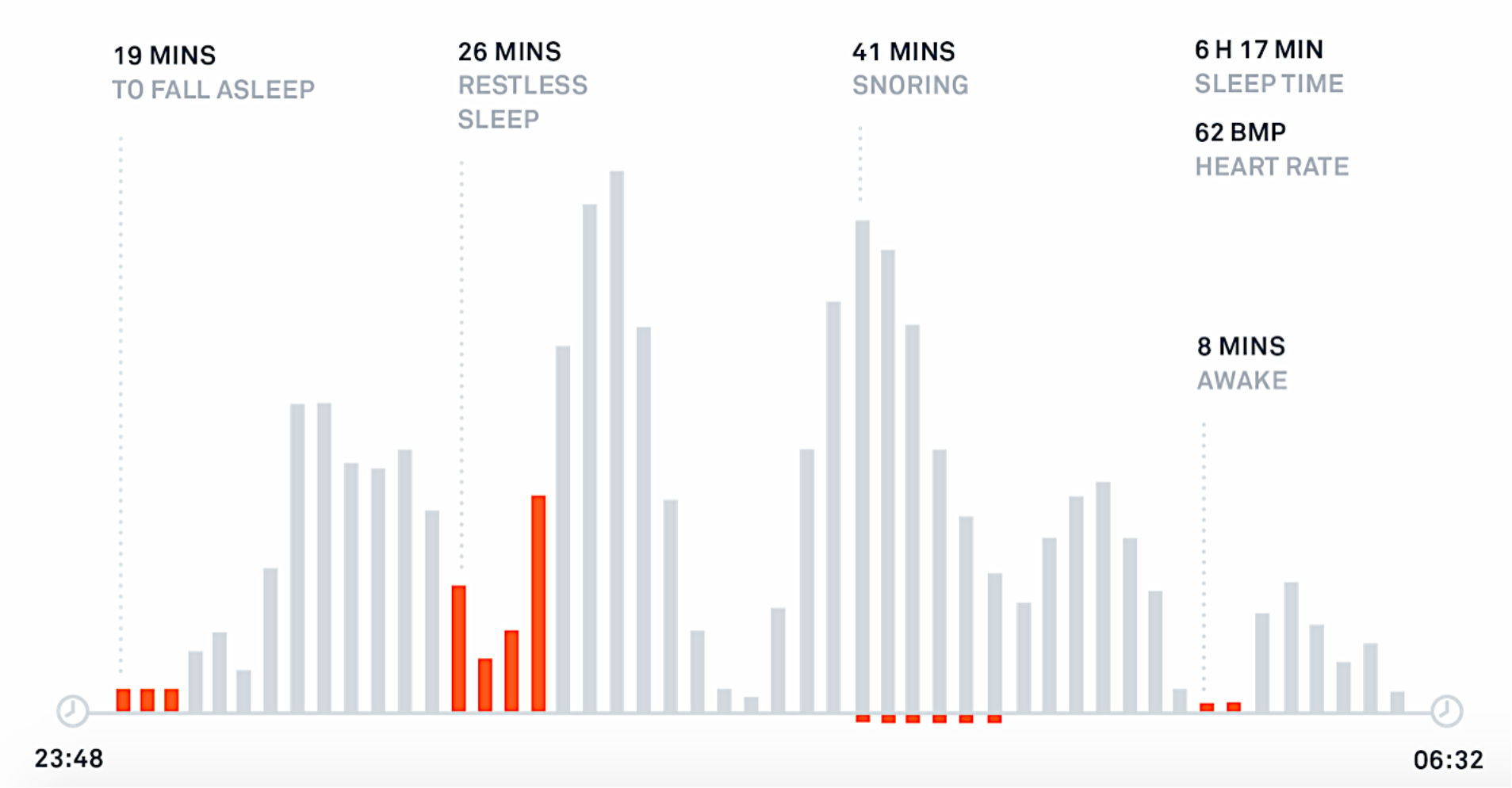
Optimize your sleep environment

8

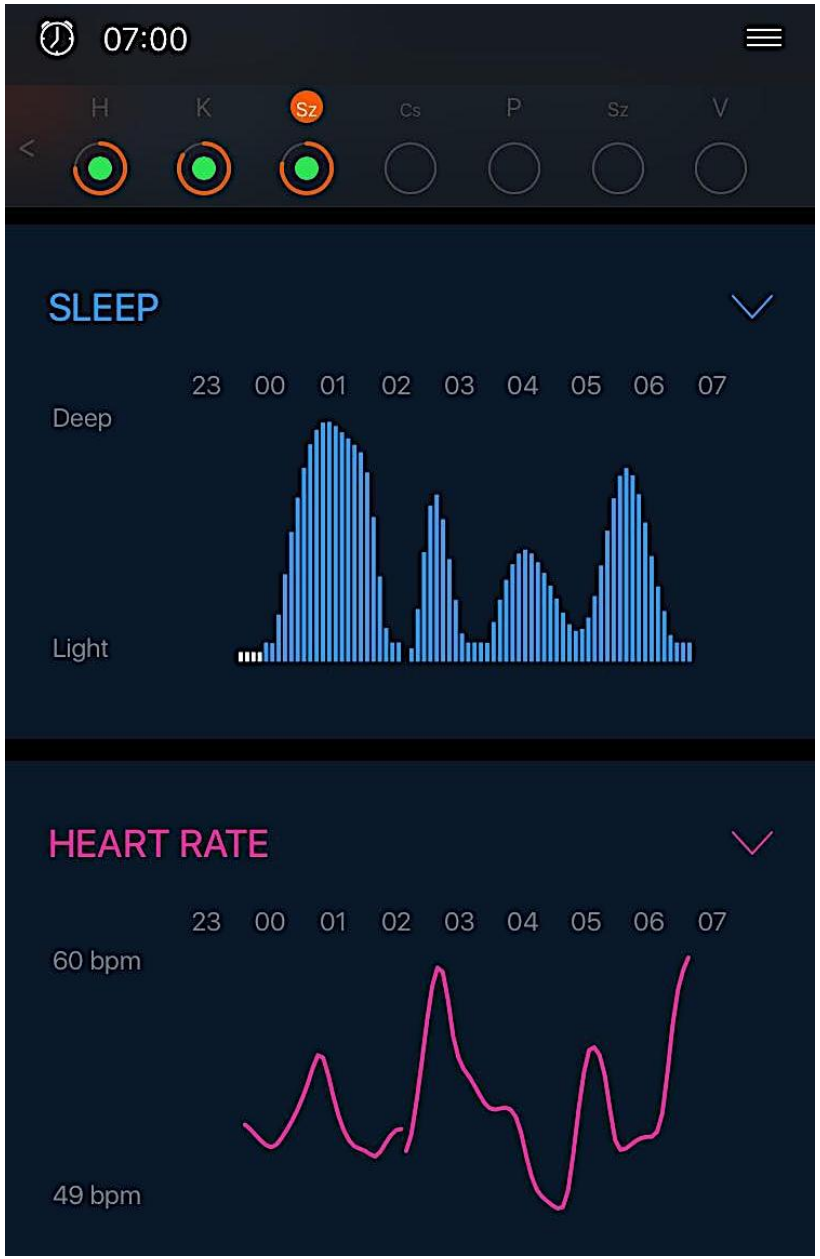
Bluetooth Smart data transfer

All results, instantly in the Beddit app

beddit


19 MINS
TO FALL ASLEEP
26 MINS
RESTLESS
SLEEP
41 MINS
SNORING
6 H 17 MIN
SLEEP TIME
62 BMP
HEART RATE
8 MINS
AWAKE
23:48
06:32

beddit


07:00
H
K
Sz
Cs
P
Sz
V
SLEEP
23 00 01 02 03 04 05 06 07
Deep
Light
HEART RATE
23 00 01 02 03 04 05 06 07
60 bpm
49 bpm

07:00
H
K
Sz
Cs
P
Sz
V
MONDAY, MAY 21
SLEEP
92
SLEEP SCORE
7 59
↑ 27 min
SLEEP TIME
h/min
97
↔
EFFICIENCY
%
47
↑ 1
HEART RATE
bpm
15
↑ 1
RESPIRATION
breaths/min

beddit

07:00
H
K
Sz
Cs
P
Sz
V
SLEEP
00 01 02 03 04 05 06 07
Deep
Light
HEART RATE
00 01 02 03 04 05 06 07
62 bpm
40 bpm

07:00
H
K
Sz
Cs
P
Sz
V
WEDNESDAY, JUN 6
SLEEP
78
SLEEP SCORE
6 46
↓ 30 min
SLEEP TIME h/min
95
↓ 3
EFFICIENCY %
53
↓ 1
HEART RATE bpm
15
↔
RESPIRATION breaths/min

BORG-skálák alkalmazása a gyakorlatban

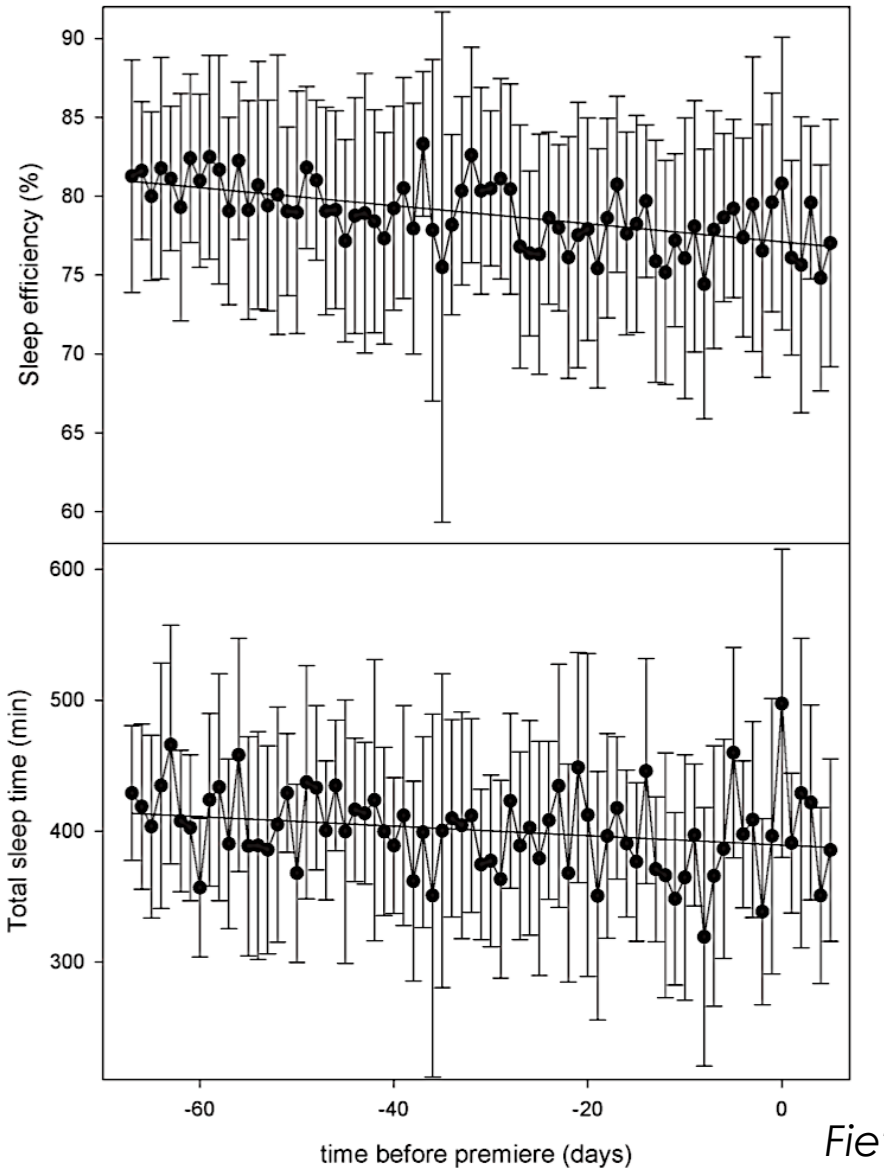
Table 1
Subjective ratings of quality of sleep, fatigue, stress and muscle soreness [3].

Sleep	Stress
1 – Very, very good	1 – Very, very low
2 – Very good	2 – Very low
3 – Good	3 – Low
4 – Average	4 – Average
5 – Bad	5 – High
6 – Very bad	6 – Very high
7 – Very, very bad	7 – Very, very high

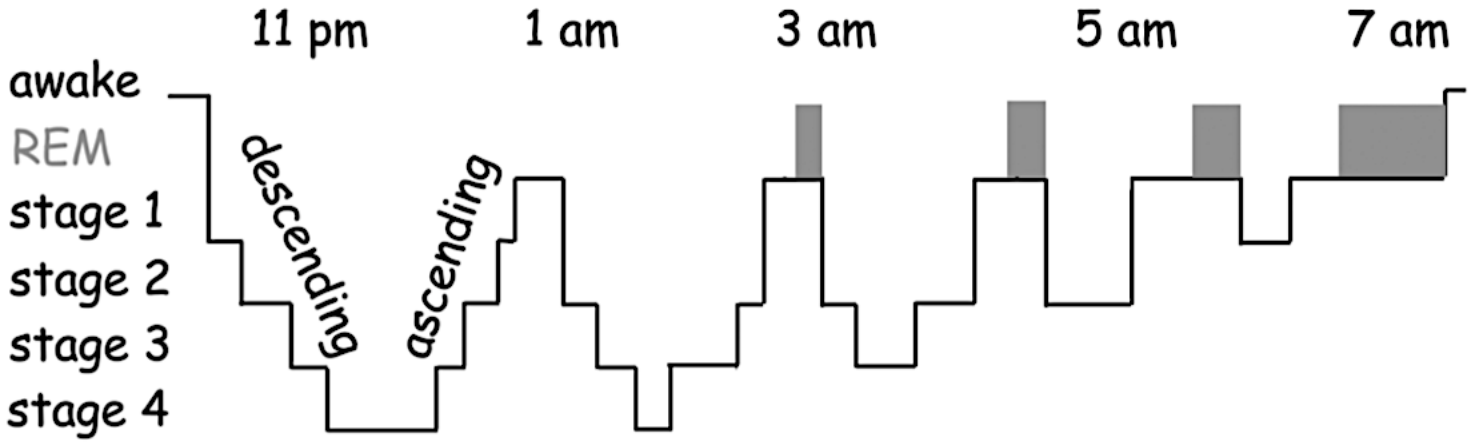
Fatigue	Muscle soreness
1 – Very, very low	1 – Very, very low
2 – Very low	2 – Very low
3 – Low	3 – Low
4 – Average	4 – Average
5 – High	5 – High
6 – Very high	6 – Very high
7 – Very, very high	7 – Very, very high

Haddad és mtsai (2013)

Alvás minősége balett táncosoknál



Fietze és mtsai (2009)



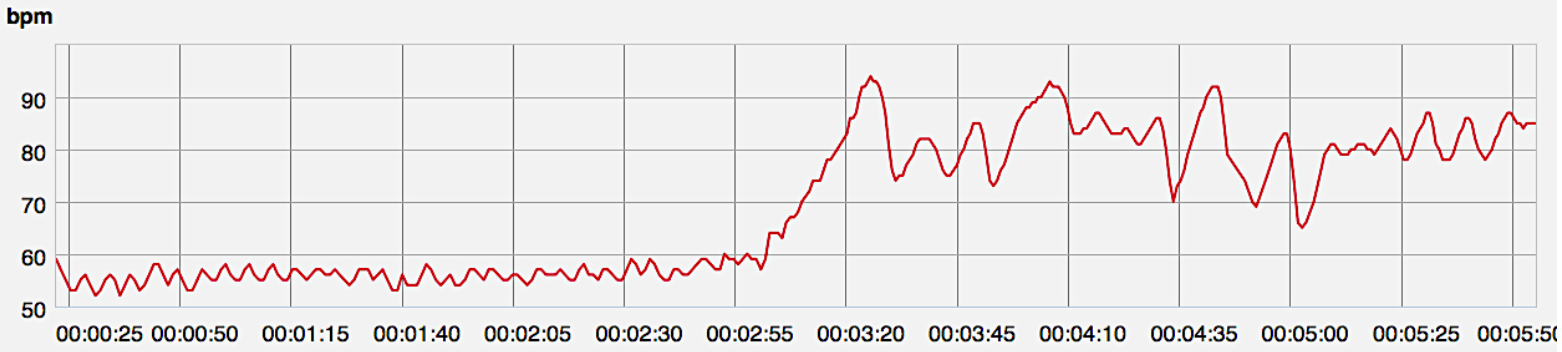
Watson és Buzsáki (2015)

Orthostatic test

Thursday Jan 19, 2017 07:19

56 -2 bpm HR rest Avg* 58	94 -4 bpm HR peak Avg* 98	82 -6 bpm HR stand Avg* 88	25 RMSSD rest Avg* 22	18 RMSSD stand Avg* 22

* Last reset of averages: 25-04-2014

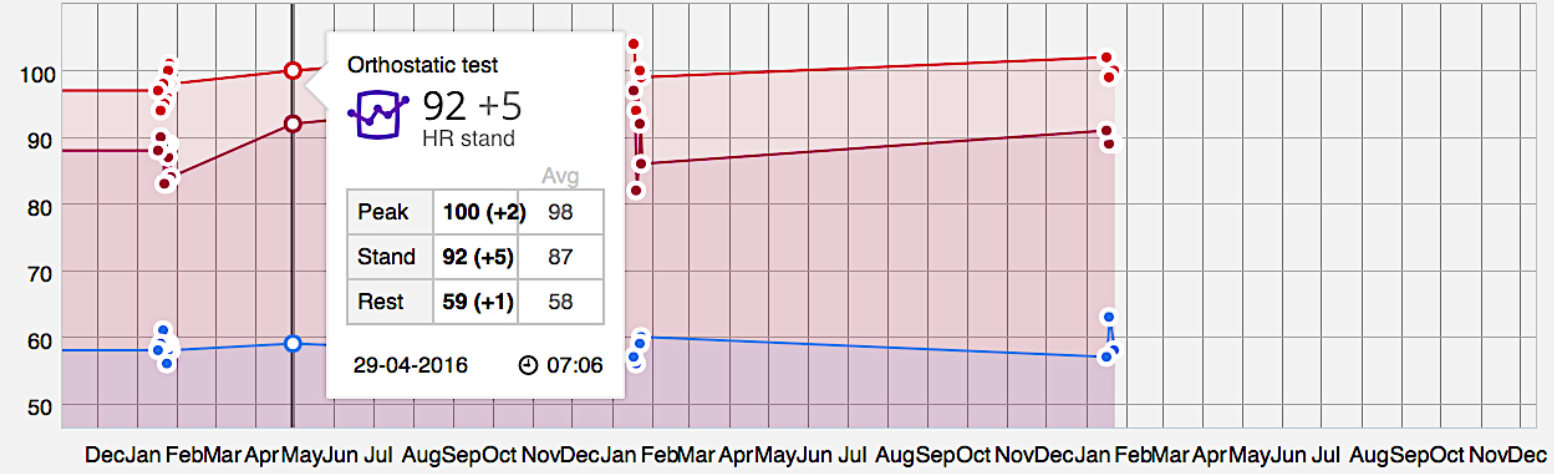


Result history

Displaying Apr 25, 2014 - Current

Heart rate | RMSSD

bpm * Last reset of averages: 25-04-2014



HRV vizsgált változói

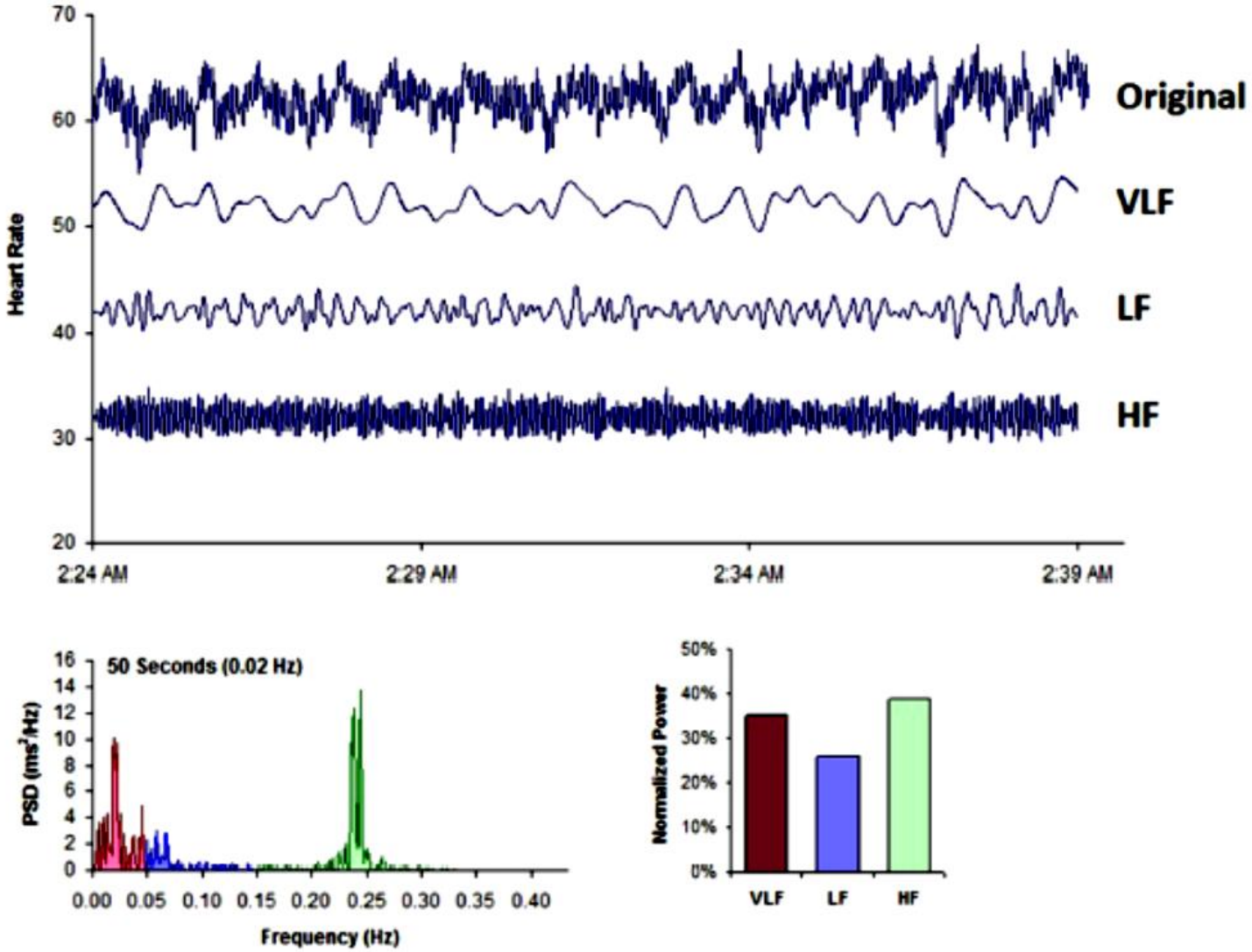
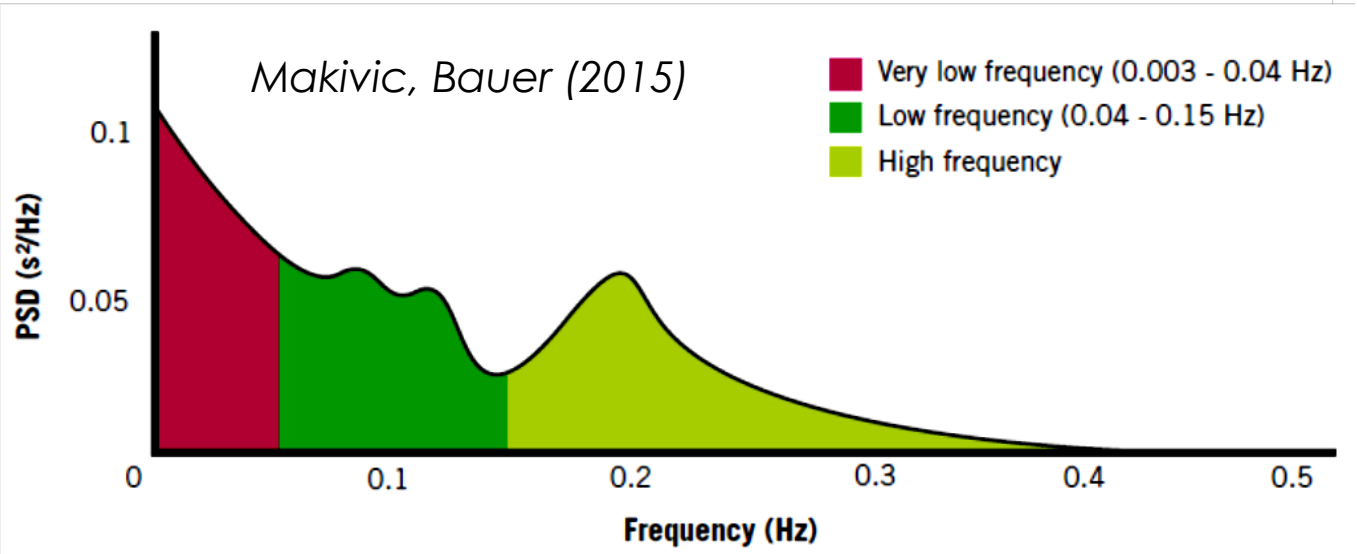
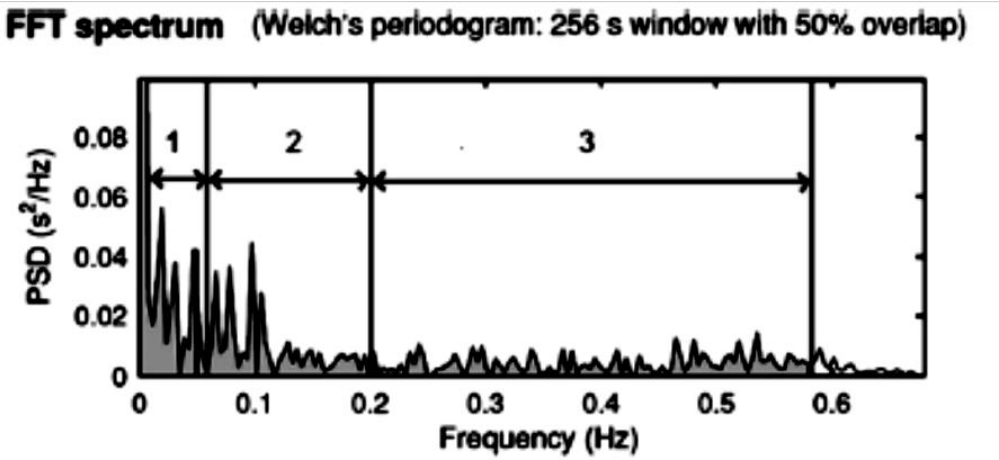


FIGURE 8 | This figure shows a typical HRV recording over a 15-min period during resting conditions in a healthy individual. The top trace shows the original HRV waveform. Filtering techniques were used to separate the original waveform into VLF, LF, and HF bands as shown in the lower traces. The bottom of the figure shows the power spectra (left) and the percentage of power (right) in each band. Credit: Institute of HeartMath.

Shaffer és mtsai (2014)

HRV spektrum elemzése



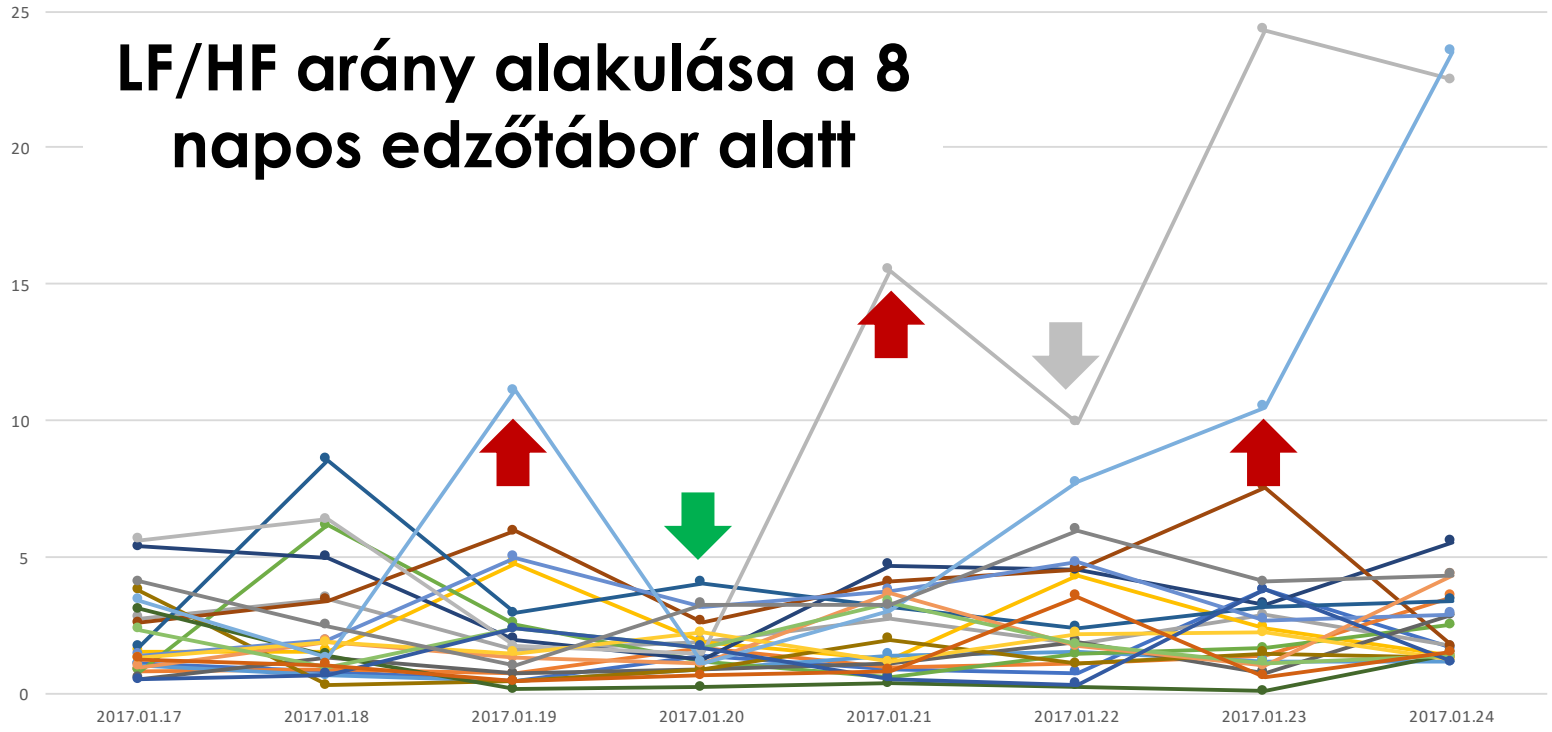


	Frequency Band	Peak (Hz)	Power (ms^2)	Power (%)	Power (n.u.)
1	VLF (0–0.05 Hz)	0.0039	2902	49.0	
2	LF (0.05–0.2 Hz)	0.0977	1414	23.9	46.7
3	HF (0.2–0.58 Hz)	0.5352	1612	27.2	53.3
	Total		5928		
	LF/HF		0.877		

Figure 2 Power spectral density (PSD) of heart rate variability (HRV) performed by Fast Fourier Transformation (FFT) using the Welch Periodogram method corresponding to the 256 values of analysis selected previously. Spectral frequency bands are obtained at very low (VLF: 0 to 0.05 Hz), low (LF: 0.05 to 0.20 Hz) and high (HF: 0.20 to 0.58 Hz) frequencies, in absolute (ms^2) and normalised units (NU). LF/HF is expressed as the ratio between the absolute areas of low and high frequency bands. Data were calculated with Kubios HRV analysis software.

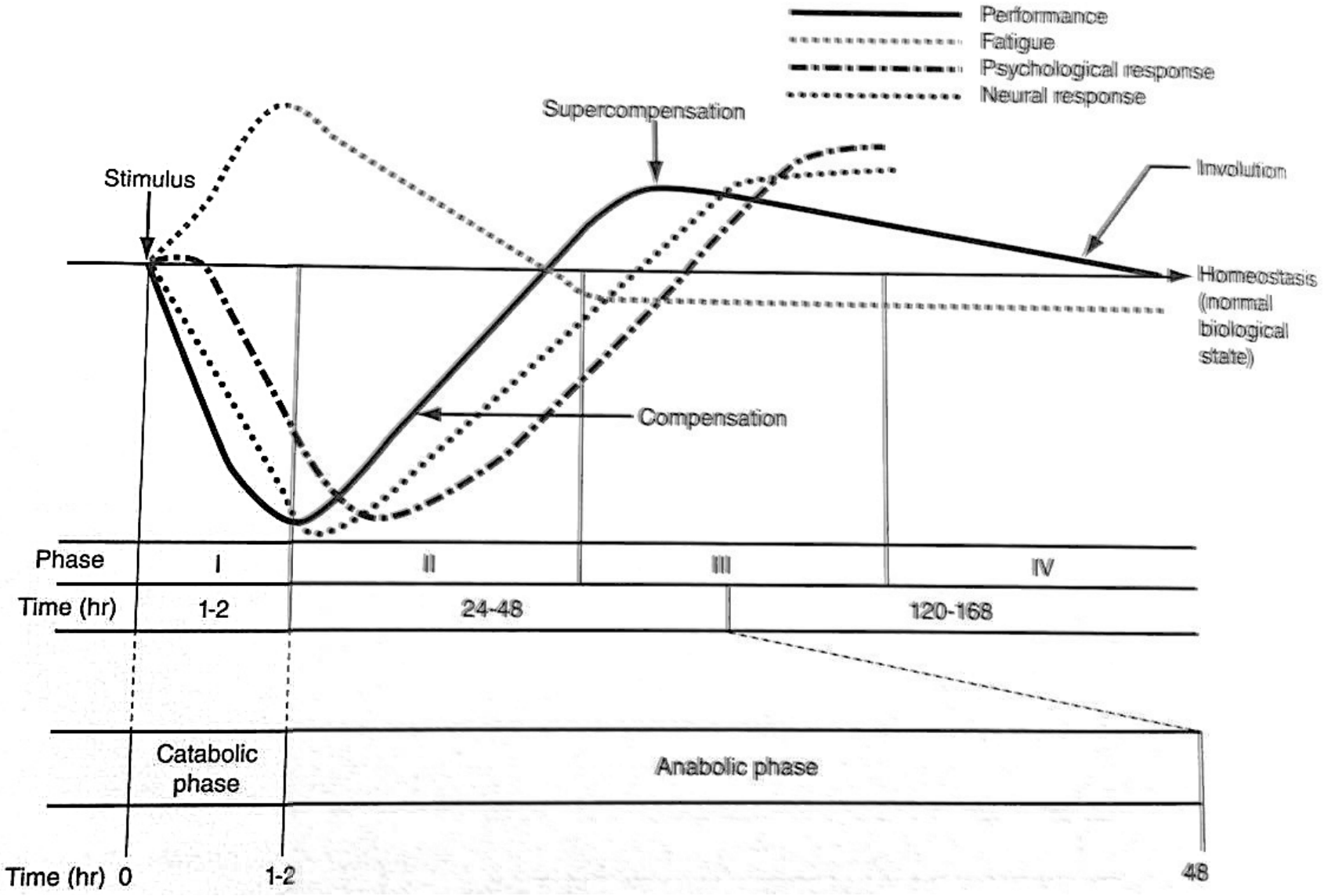
Kovács és mtsai (2014)

LF/HF arány alakulása a 8 napos edzőtábor alatt



	2017.01.17	2017.01.18	2017.01.19	2017.01.20	2017.01.21	2017.01.22	2017.01.23	2017.01.24
ASZS	1,071	0,803	0,430	1,352	0,88	0,75	3,79	1,622
BB	0,825	0,853	0,697	1,677	0,933	1,067	1,351	3,539
BT	2,765	3,456	1,560	1,888	2,76	1,793	2,859	1,705
EJ	1,530	1,514	4,765	1,863	1,199	4,291	2,393	1,342
FÁ	1,015	0,640	0,414	0,865	1,378	1,503	1,179	1,147
GYT	0,822	6,135	2,527	1,151	0,596	1,425	1,629	2,484
IZ	5,378	4,981	1,978	1,253	4,669	4,508	3,24	5,558
KF	2,581	3,399	5,919	2,616	4,086	4,521	7,543	1,696
MA	0,527	1,271	0,720	0,843	1,119	1,902	0,74	2,840
NR	3,735	0,266	0,405	0,891	1,966	1,051	1,461	1,294
NT	1,712	8,560	2,945	4,052	3,146	2,382	3,169	3,380
NÁ	3,076	1,378	0,136	0,216	0,348	0,24	0,07	1,448
PCS	1,391	1,919	4,951	3,18	3,752	4,775	2,67	2,883
SP	0,971	1,900	1,286	1,055	3,632	1,707	0,984	4,320
SZZS	5,599	6,372	1,710	1,445	15,498	9,901	24,305	22,493
SZG	1,297	1,862	1,458	2,197	1,133	2,169	2,211	1,197
TJ	3,381	1,271	11,074	1,101	3,039	7,732	10,469	23,506
UE	2,301	0,922	2,344	1,66	3,311	1,767	1,106	1,357
GGY	0,477	0,679	2,340	1,666	0,519	0,303	3,79	1,137
KK	1,257	1,039	0,405	0,626	0,827	3,547	0,592	1,513
VI	4,059	2,460	0,991	3,244	3,204	5,964	4,085	4,320

Egy edzés terhelésének szerkezeti elemei, a szuperkompenzáció bázisa



DISTANCE

Fundamental volume metric for understanding basic load levels.

ACCELERATION

Important performance metric differentiating athlete speed explosion.

DECELERATION

Ultimate measurement of the stress placed on the body after a session.

CHANGE OF DIRECTION

Measurement that assesses athlete biomechanical strengths and tendencies.

HOTSPOT PLOTS

Tactical and performance tool that assesses athlete positional tendencies.

HEART RATE

Internal measure of stress that is the physiological cost of athlete movement.

PLAYERLOAD

All-encompassing measure of physical load placed on athlete with one figure.

JUMPS

Specific performance measurement covering both height and frequency.

COLLISIONS

Assessment of the physical trauma placed on the musculoskeletal sytem.

RHIE

Repeat High Intensity Efforts assess ability to perform intensely repeatedly.

POSITION

Fundamental metric needed for velocity, distance and tactical analysis.

ASYMMETRY

Reduce athlete imbalances from skill-based movement asymmetries.

METABOLIC POWER

Direct physiological metric that monitors cost of power generation.

SPEED ZONES

Differentiates whether athlete is performing at intensity and their output.

VELOCITY

Fundamental intensity metric that measures performance with true speed.

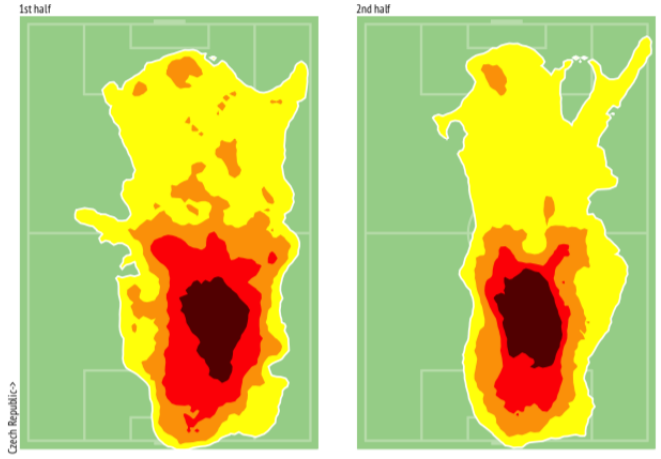
catapult.

STATSports
VIPER METRICS

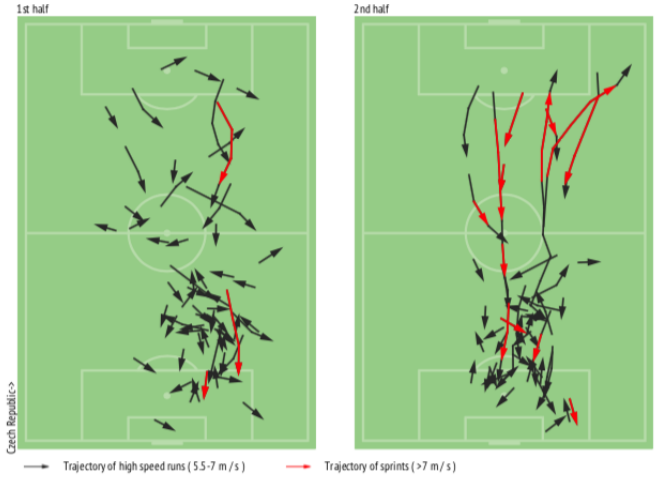
InStat

	per match		1st half		2nd half	
Total distance (m)	11 382		5 793		5 590	
Walk 0-2 m / s (m)	3 462	30%	1 681	29%	1 781	32%
Jog 2-4 m / s (m)	4 945	43%	2 565	44%	2 380	43%
Run 4-5.5 m / s (m)	1 904	17%	1 068	18%	836	15%
High speed runs 5.5-7 m / s (m)	861	8%	427	7%	434	8%
Sprints >7 m / s (m)	211	1.9%	52	0.9%	159	2.8%
High speed runs (Number)	85		50		35	
Sprints (Number)	13		3		10	

Player's movements in the match



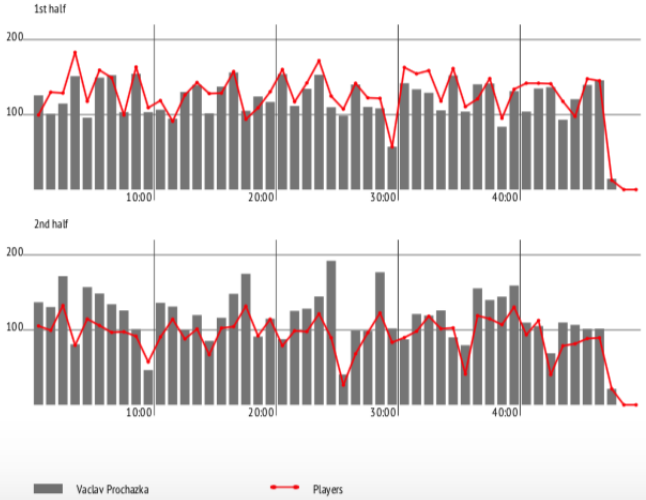
Player's high speed movements and sprints in the match



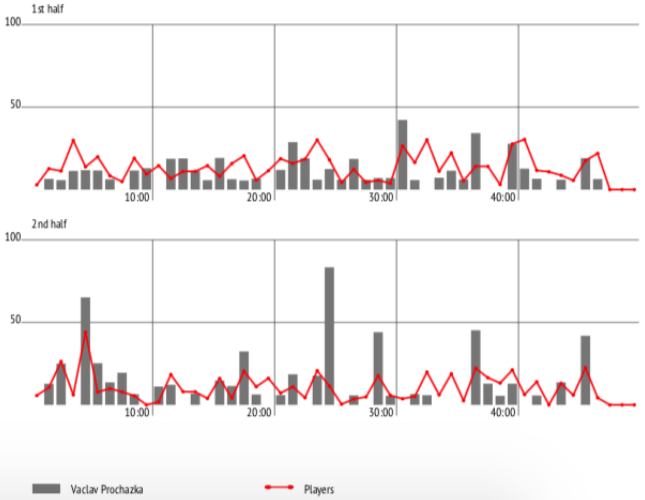
Additional parameters of a player's physical activity

	per match		1st half		2nd half	
Average speed (m / s)	2.01		2.06		1.97	
Maximal speed (m / s)	8.6		7.9		8.6	
Energy expence (kcal)	1 570		822		748	
Total distance defensive (m)	5 036	44%	2 505	43%	2 531	45%
Total distance attacking (m)	2 182	19%	979	17%	1 202	22%
High speed + sprints distance defensive (m)	408	3.6%	116	2.0%	293	5%
High speed + sprints distance attacking (m)	233	2.0%	78	1.3%	155	2.8%

Total distance (every minute comparing with average distance of field players), m



Distance on speed over 5.5 m/s (every minute comparing with average distance of field players), m



Training report

January 2018

33
Training sessions

37:38
Duration
Session avg 01:08

75,5 km
Distance
Session avg 2,3

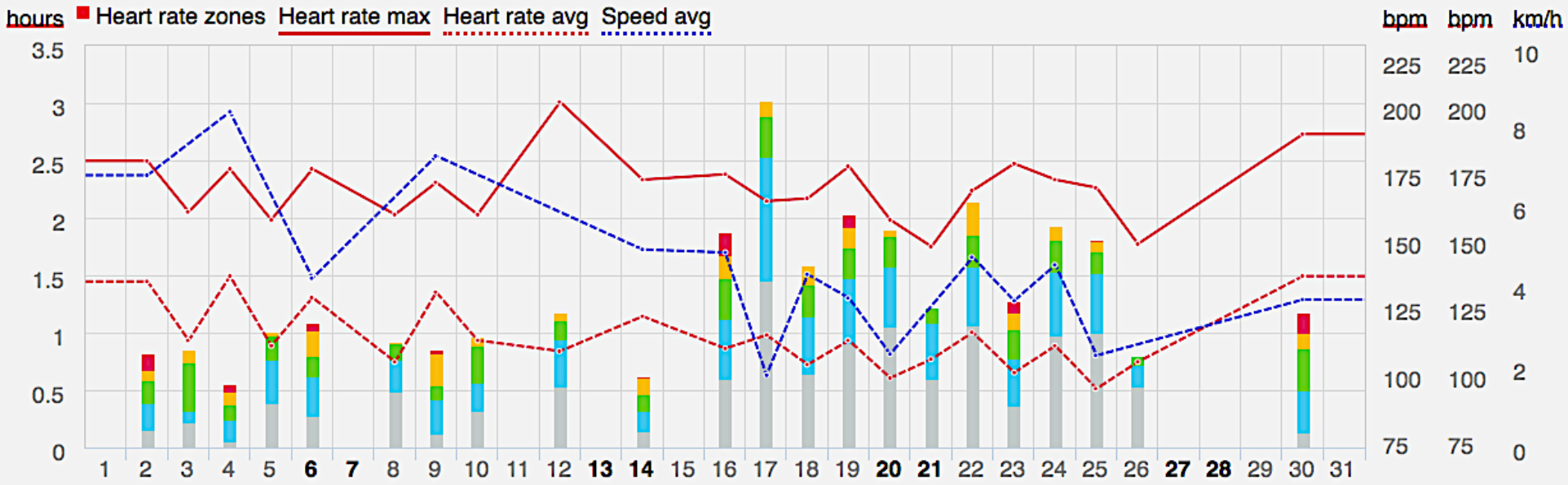
22744 kcal
Calories
Session avg 689

7410 m
Ascent
Session avg 225

3330 m
Descent
Session avg 101

All sports

Speed | Pace | Show Days



Bar graph

- Session
- Duration
- Distance
- Calories
- Ascent and descent
- Heart rate zones
- Speed zones
- Power zones

Line graph max 3

- [x] Heart rate max
- [x] Heart rate avg
- Speed max
- [x] Speed avg
- Running index
- Cadence max
- Cadence avg

Yo-Yo Intermittent Recovery Teszt Level 1-2 protokoll

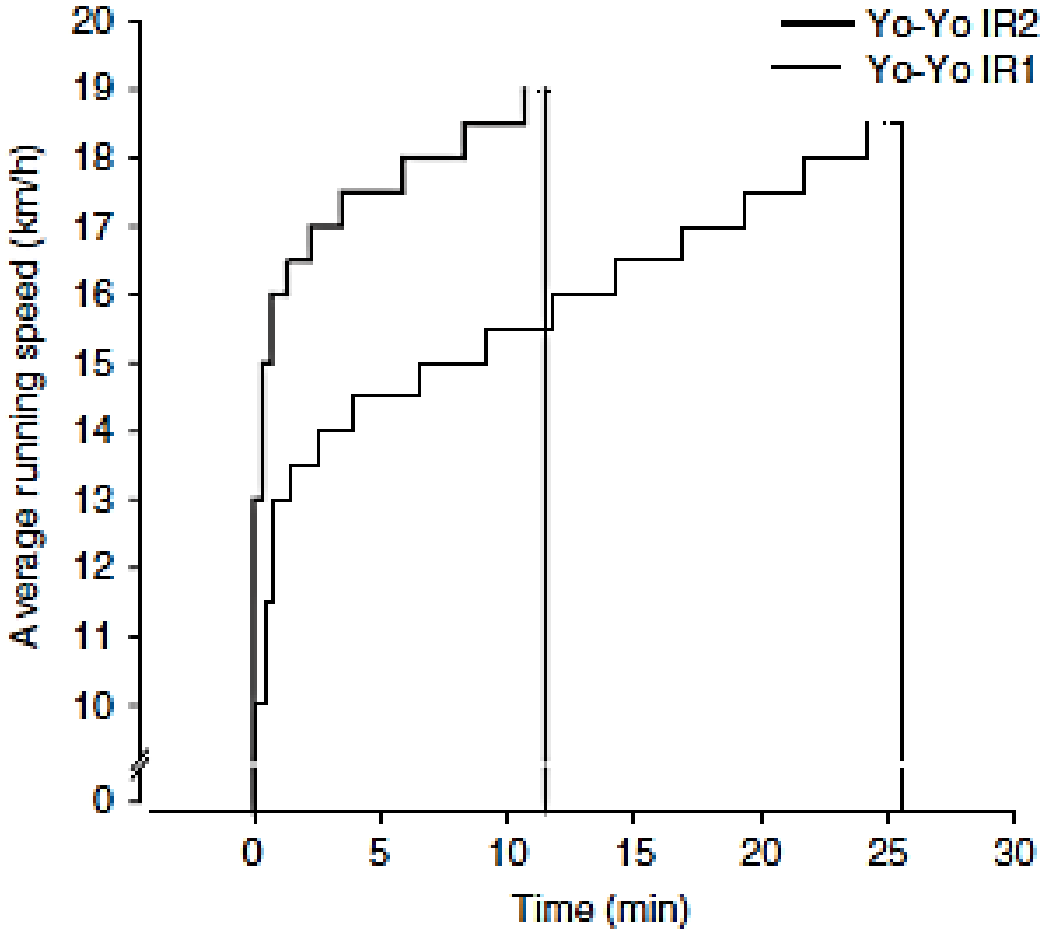


Fig. 1. Schematic representation of the Yo-Yo intermittent recovery level 1 (Yo-Yo IR1) and level 2 (Yo-Yo IR2) tests (reproduced from Krustrup et al.,[15,17] with permission).

Bangsbo és mtsai (2008)

Yo-Yo Intermittent Recovery Teszt Level 1-2 labdarúgóknál

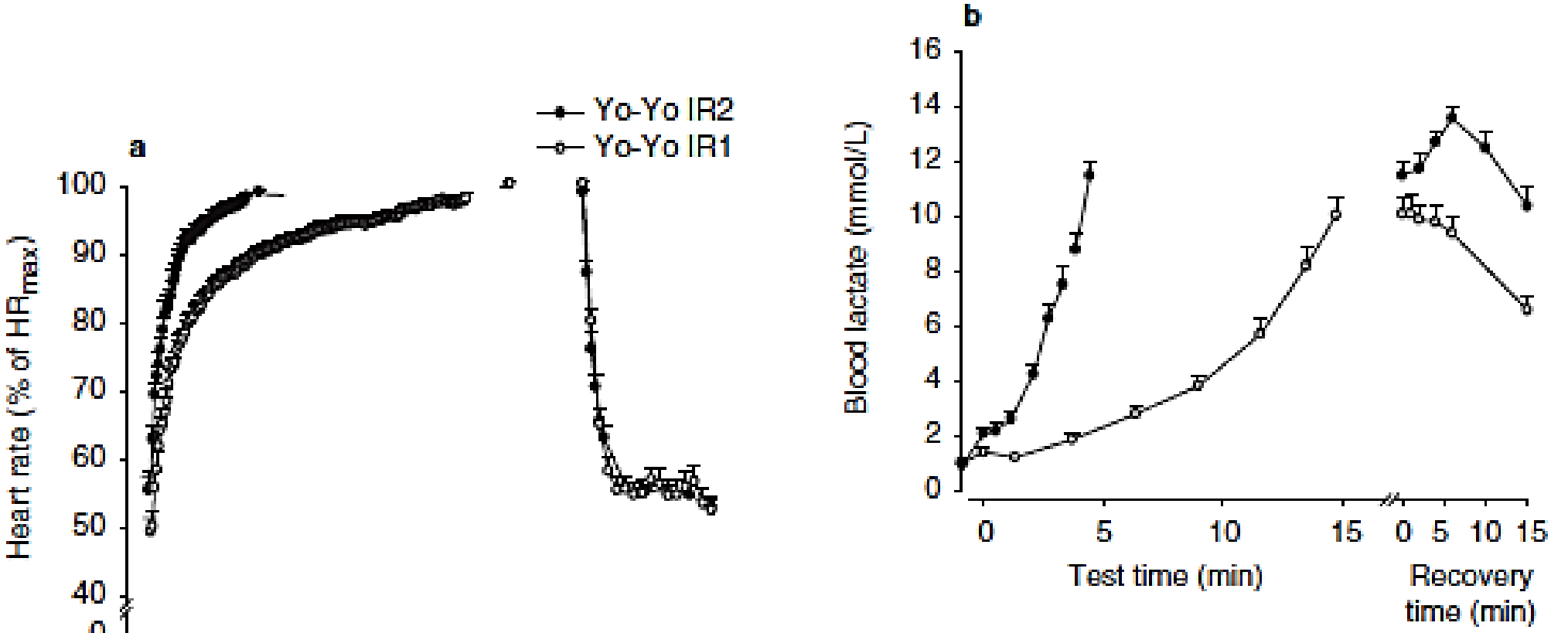
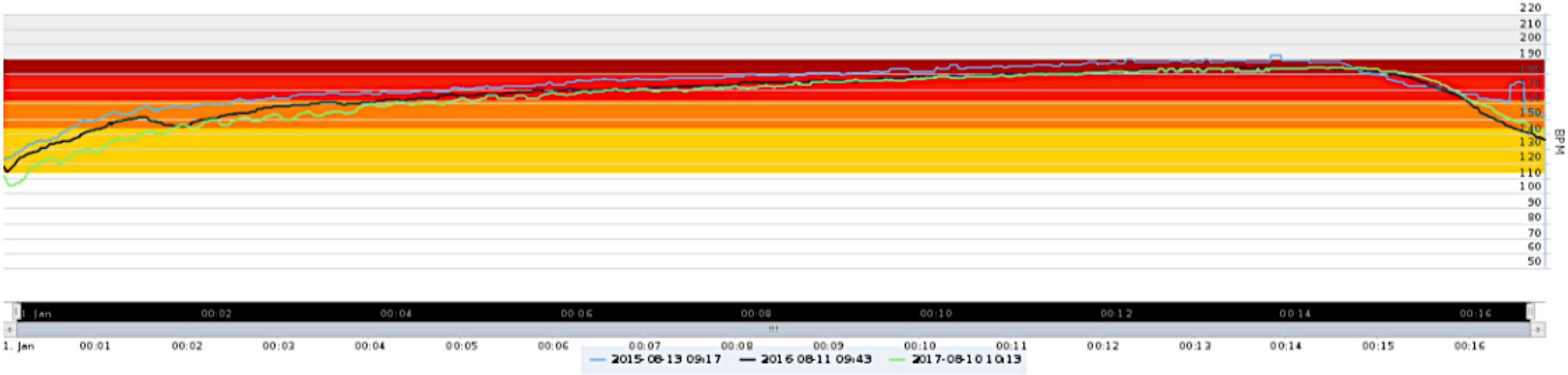


Fig. 2. Heart rate expressed as a percentage of (**a**) maximal heart rate (HR_{max}) and (**b**) blood lactate before, during and after the Yo-Yo intermittent recovery level 1 (Yo-Yo IR1) and level 2 (Yo-Yo IR2) tests. Values are mean ± standard error of the mean (reproduced from Krustrup et al.,[15,17] with permission).

Bangsbo és mtsai (2008)

Yo-Yo Intermittent Recovery Teszt Level 1 (3 éves periódus)



HR Load meghatározása (Gilis és mtsai, 2011)

idő x 5=idő$_5$
idő x 4=idő$_4$
idő x 3=idő$_3$
idő x 2=idő$_2$
idő x 1=idő$_1$

Σ

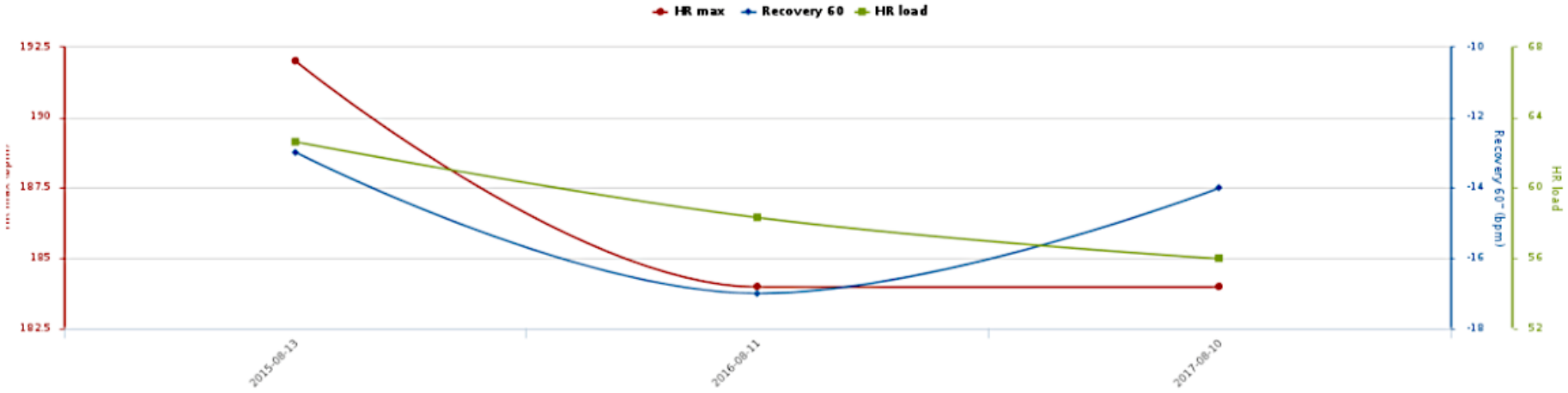
0" = .0
5" = .1
10" = .2
15" = .3
20" = .3
25" = .4

30" = .5
35" = .6
40" = .7
45" = .8
50"

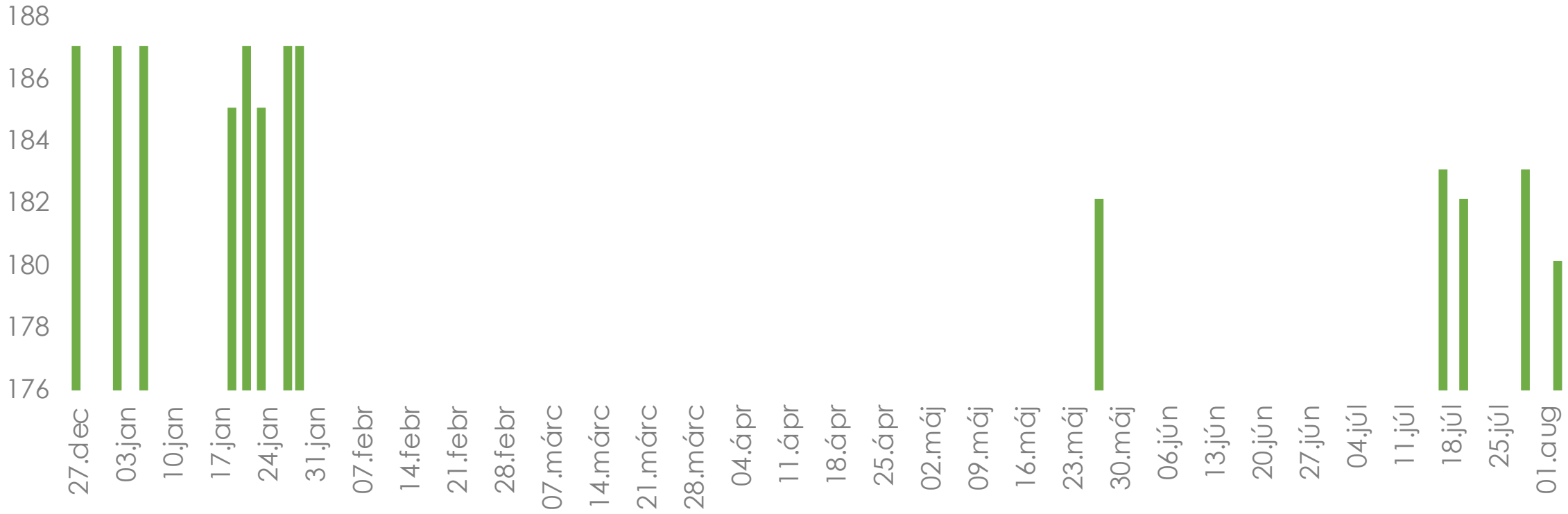
Yo-Yo Submaximal Intermittent Recovery Test

Referees
UEFA First

	2015-08-13	2016-08-11	2017-08-10
HR Max BPM	192	184	184
Recovery 60"\BPM	-13 169 7 %	-17 166 9 %	-14 169 8 %
HR Load	62.6	58.32	56
Zone AR	0' 0" I 0%	0' 0" I 0%	0' 16" I 1.8%
Zone LI	0' 43" I 4.84%	1' 4" I 7.2%	1' 35" I 10.69%
Zone me	1' 56" I 13.05%	3' 11" I 21.48%	3' 10" I 21.37%
Zone HI	5' 28" I 36.9%	6' 12" I 41.84%	5' 56" I 40.04%
Zone MI	6' 42" I45.22%	4' 22" I29.47%	3' 52" I26.1%



YoYoIRL1 teszt maximális munkapulzus



27.dec	02.jan	06.jan	19.jan	21.jan	23.jan	27.jan	29.jan	27.máj	17.júl	20.júl	29.júl	03.aug
187	187	187	185	187	185	187	187	182	183	182	183	180

	RPIc	RPIa	RPI HR	Duration	HR avg	HR max	HRI AR	HRI Light	HRI Med	HRI High	HRI Max	Cal.	Ses. HB
							53 - 117	118 - 148	149 - 168	169 - 183	184 - 195		
X		17	12.83	152	152	198	29 | 19.1%	20 | 13.2%	48 | 31.6%	49 | 32.2%	6 | 3.9%	2475	23066
Workload:		0 Coach		1950.16 Player			Aerobic: 97 min			Anaerobic: 55 min			
Team			13	152	152	198	29 | 19.1%	20 | 13.2%	48 | 31.6%	49 | 32.2%	6 | 3.9%		

	Sub 1 - Sub 2	Sub 2 - Sub 3	Sub 3 - Sub 4
Time	44' 43"	15' 15"	48' 0"
RPI Coach	/	/	/
RPI Hr	15.02	8.06	14.63
RPI Load	672	123	702
HR Load	156.83	23.17	163.08
HR Max	182 bpm 93%	180 bpm 92%	181 bpm 93%
HR Avg	167 bpm 86%	120 bpm 62%	165 bpm 85%
TRIMP	10063	1068	10328
	Sub 1 - Sub 2	**Sub 2 - Sub 3**	**Sub 3 - Sub 4**
Active Recovery	0' 0"	8' 40"	0' 50"
Light Intensity	1' 10"	5' 40"	3' 10"
Medium Intensity	19' 50"	0' 30"	20' 5"
High Intensity	23' 45"	0' 25"	23' 55"
Maximum Intensity	0' 0"	0' 0"	0' 0"

	Start	0"	30"	60"	90"	120"
1	20:48:30	180 bpm	-13 167 bpm 7%	-37 143 bpm 21%	-48 132 bpm 27%	-44 136 bpm 24%
2	21:51:45	175 bpm	-22 153 bpm 13%	-34 141 bpm 19%	-51 124 bpm 29%	-50 125 bpm 29%

Spanyol elit labdarúgók 8 hetes edzése, annak hatásai (n=8)

Table 1 Player Characteristics

	Mean ± SD
Age (y)	24.0 ± 4.0
Height (cm)	178.3 ± 4.9
Mass (kg)	72.7 ± 7.1
Body fat (%)	10.7 ± 0.6
Number of preseason matches	6.8 ± 2.1
Preseason playing time (min)	386.9 ± 93.8

Boullosa és mtsai (2013)

Table 6 Workload-Related Parameters During Small-Sided Games

	Wk 1	Wk 8	*P*
Walking speed during active recovery (km/h)	2.25 ± 0.81	2.10 ± 0.76	.489
HR_{peak} values of the selected curves (beats/min)	177.1 ± 7.9	176.6 ± 8.8	.838
Mean distance (m) covered per minute	76.7 ± 6.9	72.3 ± 6.9	.137
Number of accelerations per minute	1.74 ± 0.27	1.65 ± 0.38	.432
Work-to-rest ratio	0.65 ± 0.13	0.70 ± 0.15	.442

Table 2 Weekly Training Summary From Week 1 to Week 8

Week number	Total weekly training volume (min)	Total weekly sessions	Double-session days	Tactical Training		Technical-Tactical		Number of matches	Rest/travel days
				Sessions	min	Sessions	min		
1	805	11	5	3	216	3	221	0	1
2	684	11	4	0		4	247	3	0
3	541	7	2	2	180	3	226	1	2
4	668	9	2	1	90	4	262	2	0
5	681	8	3	0		5	431	1	2
6	687	10	3	0		5	372	2	0
7	438	6	0	0		4	300	1	1
8	349	5	2	0		3	249	0	4

Spanyol elit labdarúgók 8 hetes edzése, annak hatásai (n=8)

Table 3 Yo-Yo Intermittent Recovery Level 1 (Yo-Yo IR1) and Gacon Test Parameters During Week 1 and Week 8 of the Preseason

			Magnitude of Changes Between Weeks		
	Wk 1	Wk 8	%Δ; ±90% CL	ES	Qualitative inference
Yo-Yo IR1					
distance (m)	2475 ± 421	2600 ± 786	4.5; ±15.9	0.20	Unclear
HR_{max} (beats/min)	191.2 ± 6.8	179.0 ± 7.5*	–6.3; ±2.9	1.68	Almost certainly
Gacon test					
MAS (km/h)	18.1 ± 1.1	18.2 ± 0.9	0.4; ±2.5	0.05	Unclear
HR_{max} (beats/min)	193.9 ± 4.6	188.9 ± 5.7†	–2.6; ±1.5	0.96	Very likely

Note: Values are mean ± SD. Magnitudes of difference between weeks are expressed as mean percentage change (%Δ) and 90% confidence limits (±90% CL). ES, effect size; HR_{max}, maximum heart rate; MAS, maximum aerobic speed.

*P = .004. †P = .013, different vs wk 1.

Boullosa és mtsai (2013)

Spanyol elit labdarúgók 8 hetes edzése, annak hatásai (n=8)

Table 4 Measures of Night-Time Heart-Rate Variability During Week 1 and Week 8 of the Preseason

			Magnitude of Changes Between Weeks		
	Wk 1	Wk 8	%Δ; ±90% CL	ES	Qualitative inference
mean RR (ms)	1208 ± 198	1319 ± 178	11.1; ±21.5	0.59	Likely
mean HR (beats/min)	51.0 ± 7.9	46.8 ± 6.1[a]	–8.1; ±7.3	0.45	Likely
SDNN (ms)	135 ± 50	163 ± 41*	31.7; ±32.9	0.61	Very likely
RMSSD (ms)	98.6 ± 80.9	116 ± 53	116; ±171	0.25	Unclear
LF (ms^2)	2591 ± 1715	3421 ± 1403	335; ±527	0.53	Unclear
HF (ms^2)	2958 ± 3456	3527 ± 2256	987; ±1701	0.19	Unclear
LF (ln ms^2)	7.5 ± 1.1	8.0 ± 0.5	10.1; ±13.6	0.64	Unclear
HF (ln ms^2)	7.1 ± 1.8	8.0 ± 0.6	20.6; ±23.0	0.68	Likely
LFnu	57.9 ± 20.7	52.4 ± 13.7[b]	–6.1; ±8.0	0.27	Possibly trivial
HFnu	42.1 ± 20.7	47.5 ± 13.7[c]	29.3; ±29.8	0.26	Likely
LF:HF	2.3 ± 2.3	1.3 ± 0.7	–15.7; ±22.1	0.59	Possibly
SD_1 (ms)	69.6 ± 57.1	82.6 ± 37.4	122; ±175	0.27	Unclear
SD_2 (ms)	174.2 ± 56.1	211.8 ± 53.1†	29.9; ±28.7	0.69	Likely

Values are mean ± SD. Magnitudes of difference between weeks are expressed as mean percentage change (%Δ) and 90% confidence limits (±90% CL). ES, effect size; RR, R-R interval; HR, heart rate; SDNN, standard deviation of all R-R intervals; RMSSD, root-mean-square of successive differences between normal sinus R-R intervals; LF, low-frequency power; HF, high-frequency power; LFnu, LF in normalized units; HFnu, HF in normalized units; SD_1, standard deviation of short-term R-R interval variability; SD_2, standard deviation of the long-term continuous R-R interval variability.

[a]$P = .088$. [b]$P = .082$. [c]$P = .086$. *$P = .017$. †$P = .023$, different vs wk 1.

Boullosa és mtsai (2013)

Spanyol elit labdarúgók 8 hetes edzése, annak hatásai (n=8)

Table 5 Indices of Heart-Rate Recovery (HRR) Assessed During Week 1 and Week 8 of Preseason

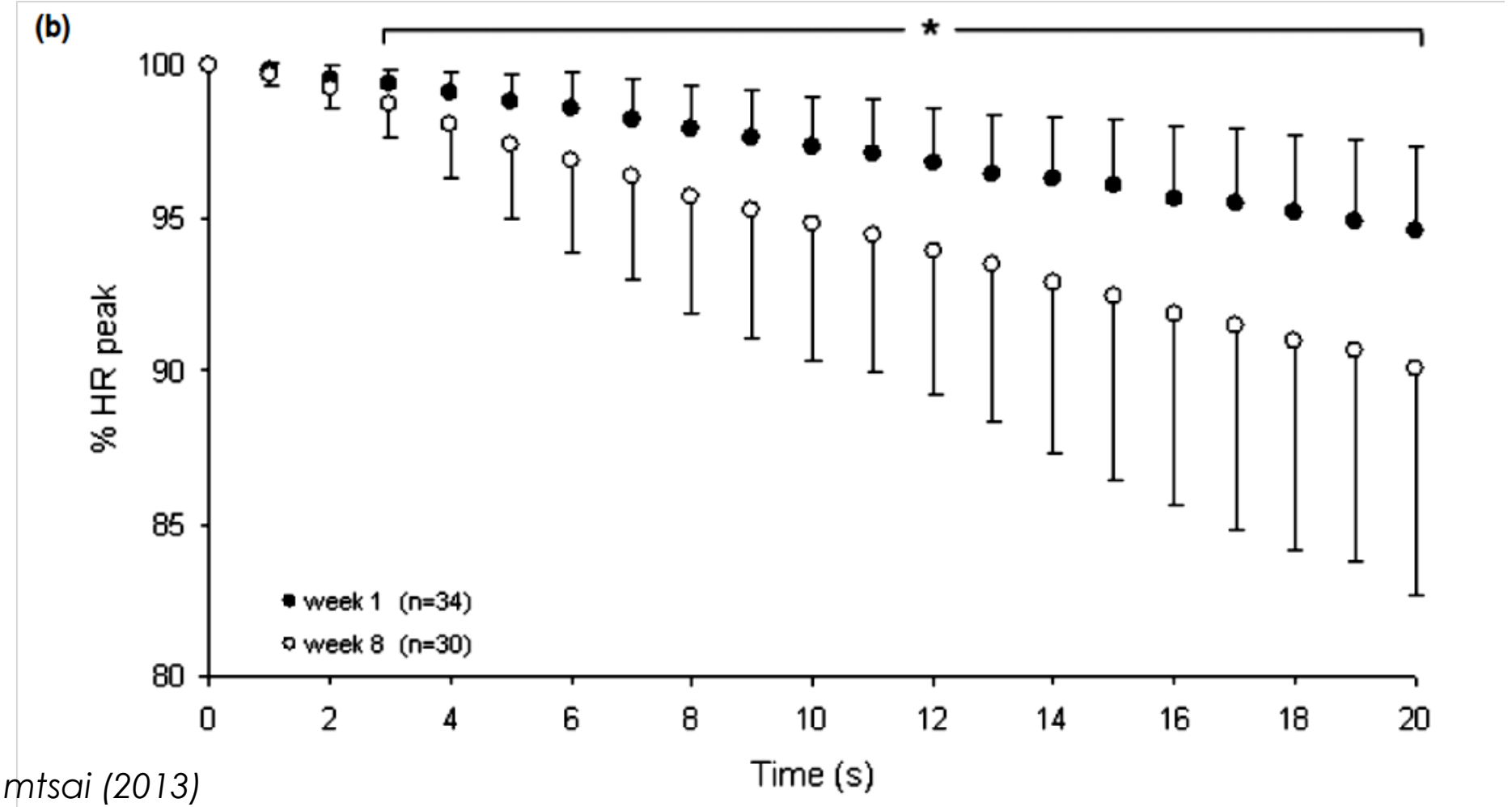
			Magnitude of Changes Between Weeks		
	Wk 1	Wk 8	%Δ; ±90% CL	ES	Qualitative inference
ΔHRR (beats/min)					
10 s	4.4 ± 1.3	7.7 ± 3.4	101.5; ±106.6	1.26	Likely
15 s	6.7 ± 1.9	11.4 ± 4.4	94.5; ±92.3	1.40	Likely
20 s	9.3 ± 1.7	15.5 ± 4.6*	73.8; ±53.5	1.80	Very likely
$\%HR_{peak}$					
10 s	97.4 ± 0.8	95.6 ± 1.8	–1.8; ±1.7	1.25	Likely
15 s	96.1 ± 1.2	93.5 ± 2.3	–2.6; ±2.3	1.41	Likely
20 s	94.5 ± 1.2	91.1 ± 2.4†	–3.5; ±2.3	1.81	Very likely
Time constant (s)					
T_{10}	568 ± 221	342 ± 127	–29.8; ±34.9	1.25	Likely
T_{15}	518 ± 177	343 ± 106	–26.6; ±29.9	1.20	Likely
T_{20}	462 ± 68	319 ± 74#	–30.4; ±15.2	2.02	Very likely

Values are mean ± SD. Magnitudes of difference between weeks are expressed as mean percentage change (%Δ) and 90% confidence limits (±90% CL). ES, effect size; ΔHRR, absolute HRR; HR_{peak}, peak heart rate; T, fast recovery.

*P = .039. †P = .025. #P = .01, different vs wk 1.

Boullosa és mtsai (2013)

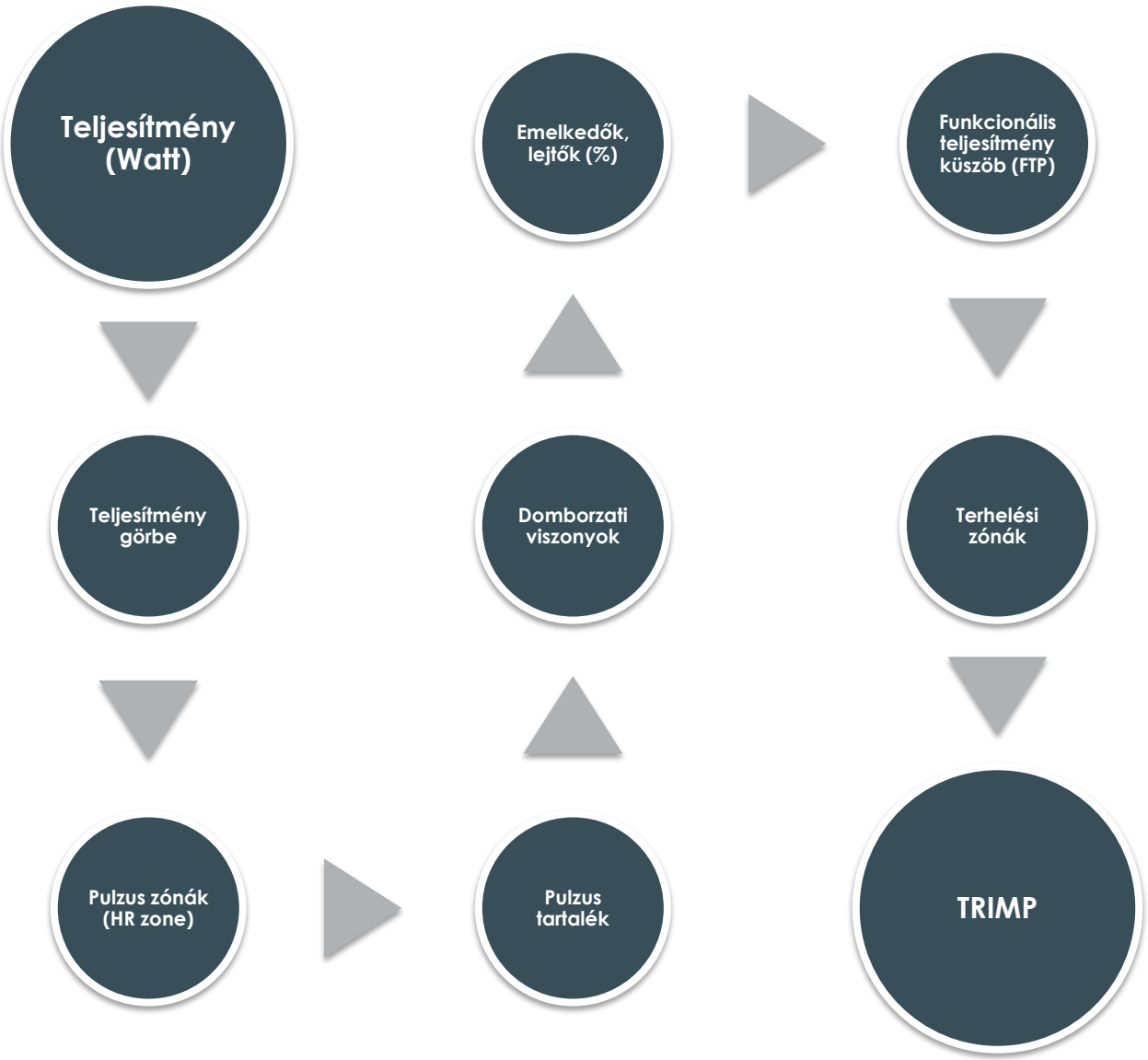
Spanyol elit labdarúgók 8 hetes edzése, annak hatásai (n=8)

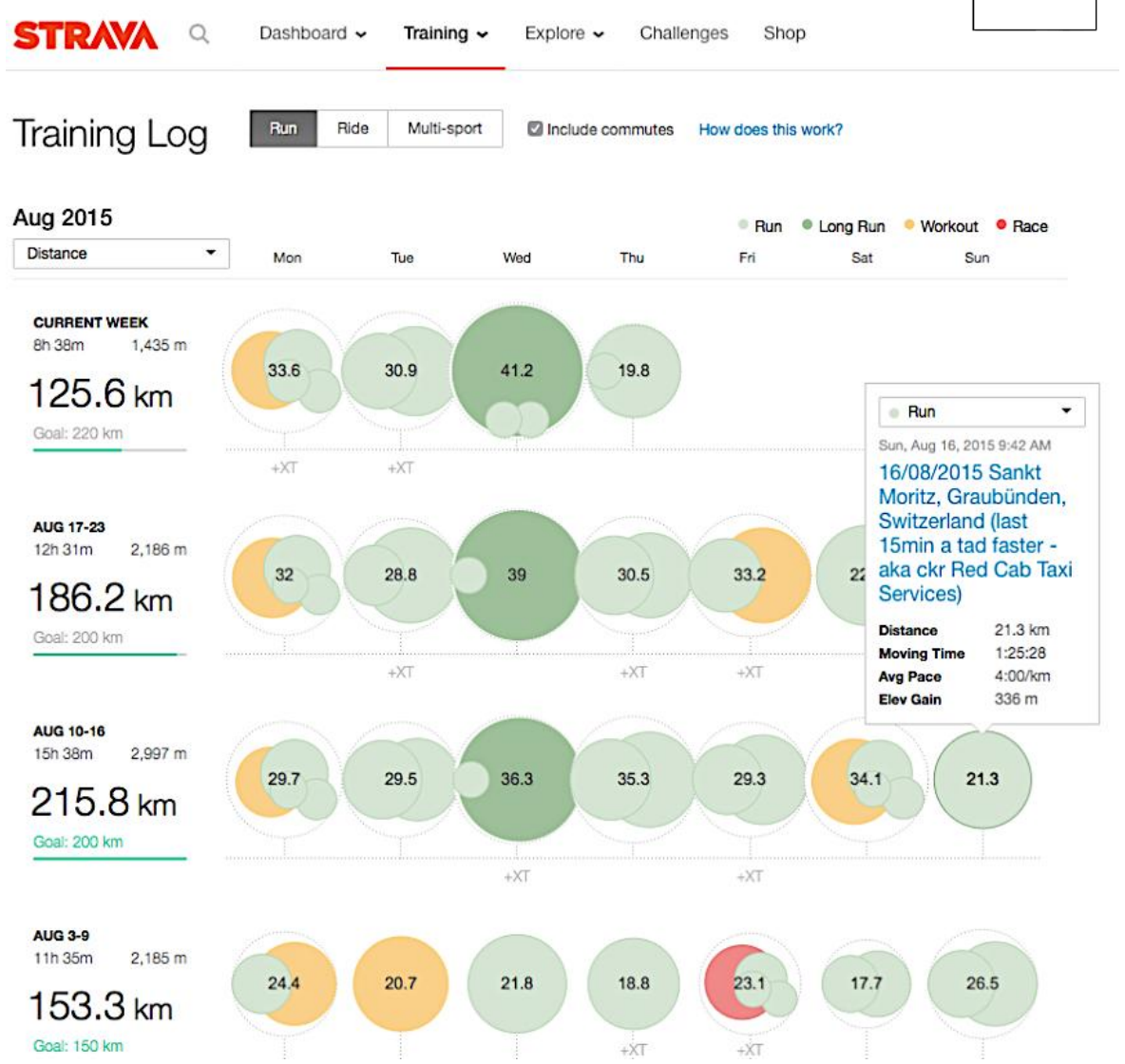


Boullosa és mtsai (2013)

Figure 2 — Heart-rate (HR) recovery at the start (wk 1) and the end (wk 8) of the preseason during small sided games. (a) Each data point represents instantaneous HR averaged across curves for each second. (b) Data points are presented as the average percentage of HR_{peak} from each single curve. $*P < .05$ vs week 8.

Kerékpár sportágban figyelembe vett terhelési változók





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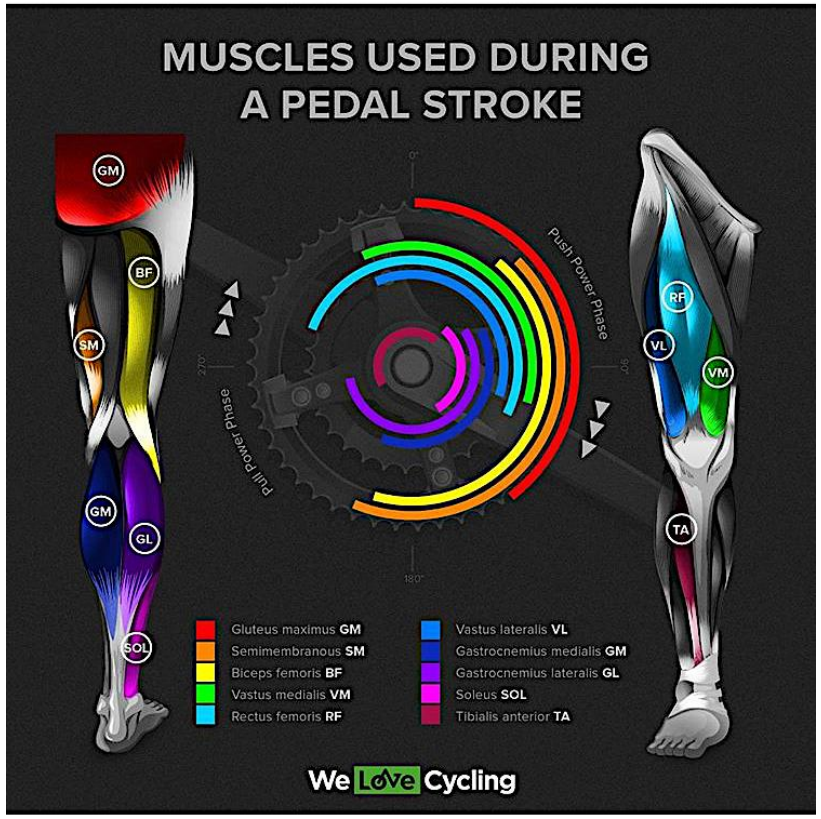

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Osimo

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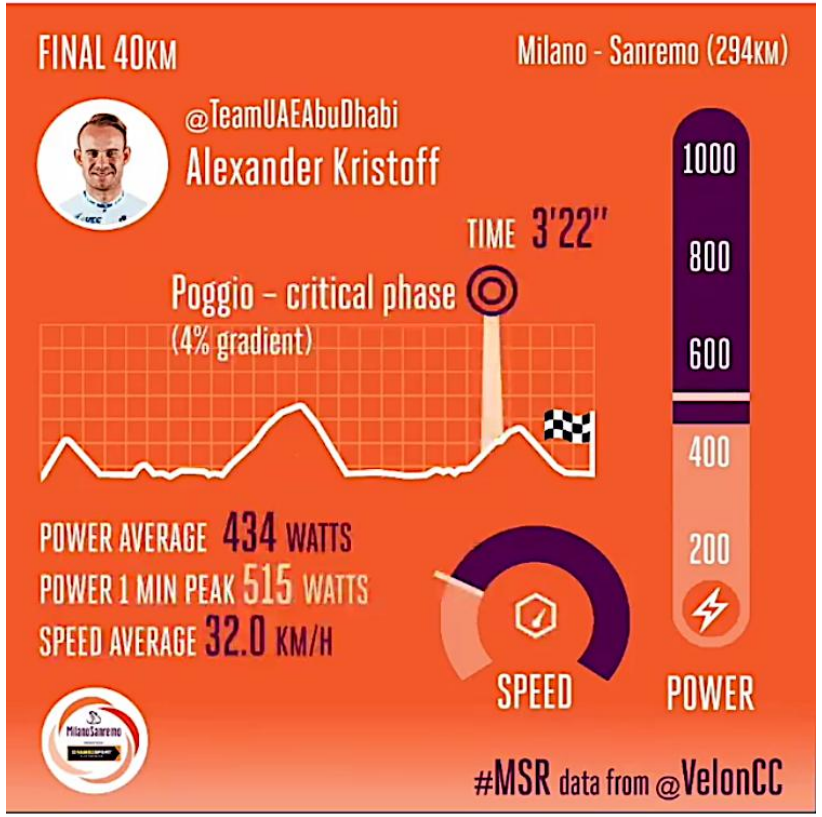
sprintcycling @simonyatess attacks on the last steep climb and goes for the 3rd victory of @giroditalia in #Osimo #photo @dariobelingheri @bettiniphoto @mitchelton_scott @bikeonscott #giroditalia #giro2018 #giro101 #phototography #picoftheday #pictureoftheday #cool

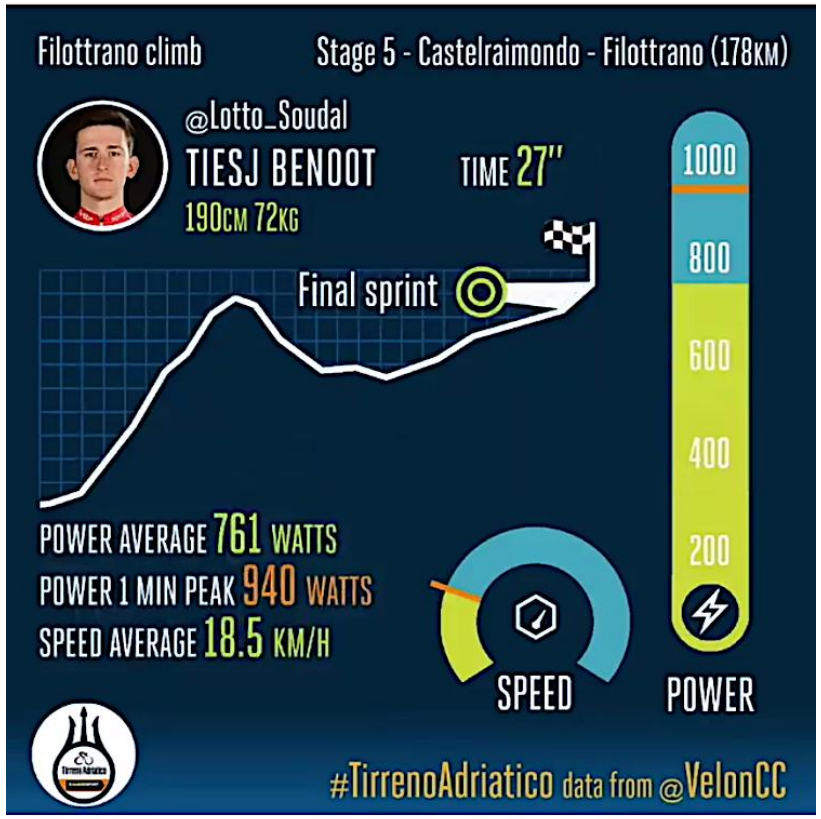
veloncc



3 827 views

veloncc Data for @kristoff87 of @uae_team_emirates on the final 40km of today's Milano-Sanremo race - which he finished in fourth place 🚴‍♂️⚡

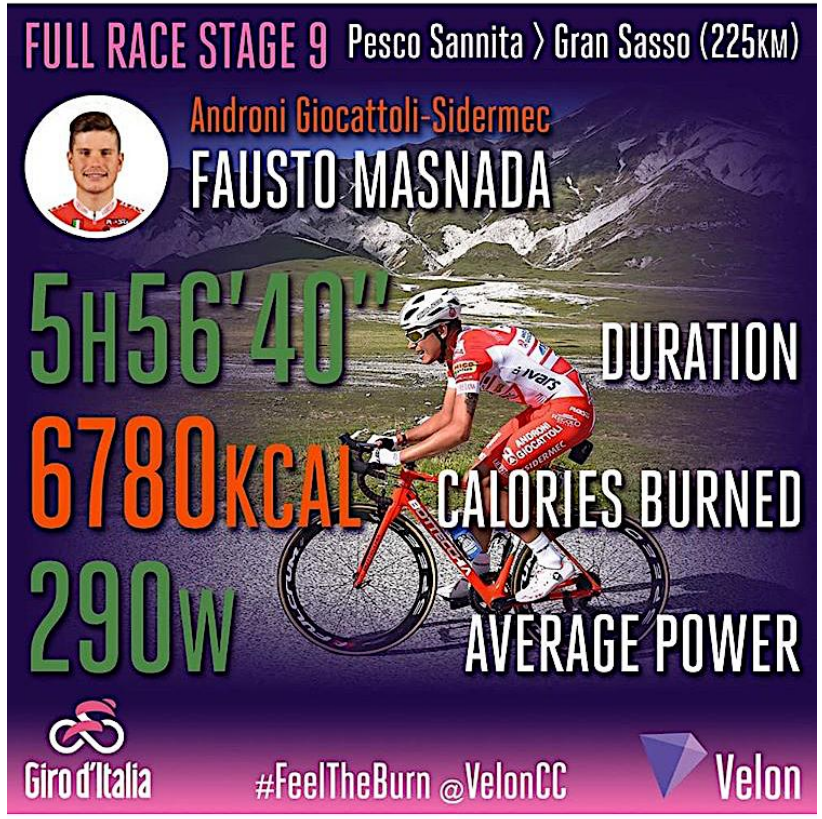
veloncc



2 185 views

veloncc #TirrenoAdriatico Stage 5: @tiesj Benoot (@lotto_soudal) proves for the third consecutive day that he really has arrived in the world elite, finishing fourth in the stage. His climbing is fantastic and in the sprint for second

veloncc



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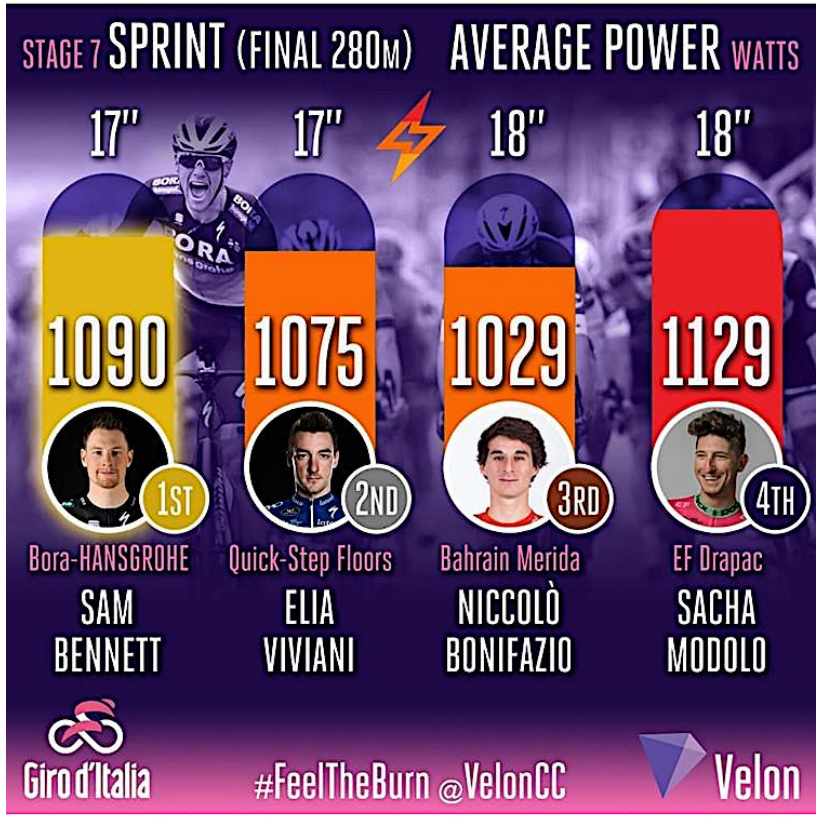
veloncc Incredible performance from Fausto Masnada (@androni_sidermec) who rode hard in the break throughout Stage 9 of the @giroditalia and made a fierce late solo attempt to go for the win! ⏱ Time: 5h56'40''

veloncc



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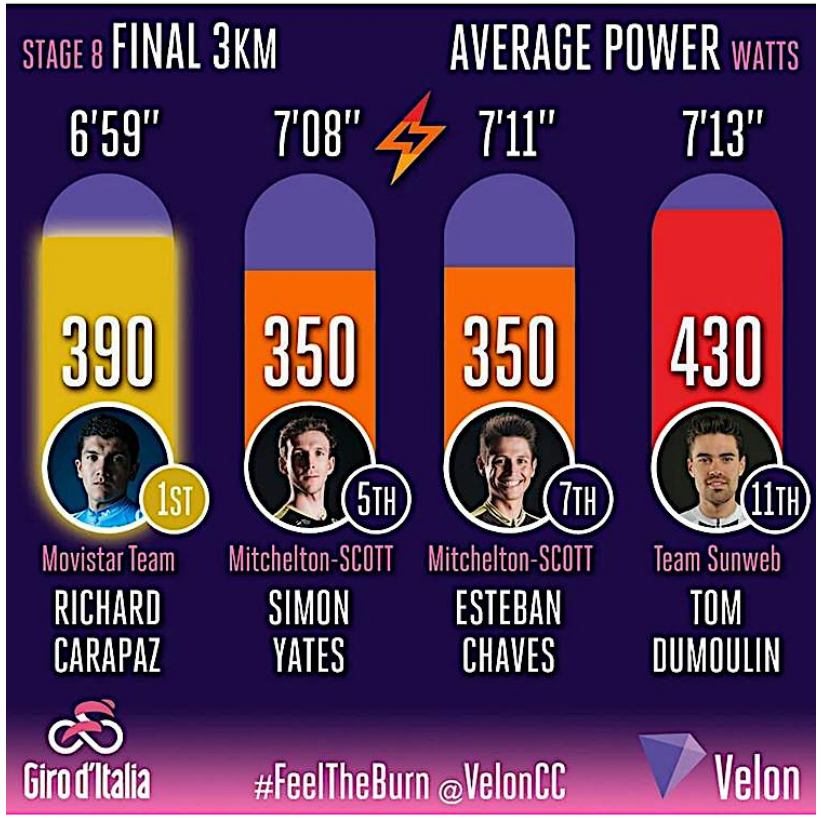
veloncc #FeeltheBurn at Giro d'Italia - VelonLive ave power data ⚡ Sam Bennett's massive stage-winning effort shows benefit of choosing the right wheel: he emerged from Elia Viviani's slipstream for his debut Grand Tour stage victory.

veloncc



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veloncc #FeeltheBurn with VelonLive - Key average power ⚡ & speed ⏩ numbers from the @giroditalia Stage 8 winner Richard Carapaz vs the top three GC riders after an enthralling final 3km on Monteveqine di Mercogliano.

teamsunweb

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teamsunweb #Repost @veloncc... more

Gearing Calculators

Coded, in JavaScript, by Scott Rose

Enter the weight of your rig-- bike, gear, and self-- the cadence you like to keep, your power output, and a grade-- and click on the "crank" button to compute the required gear ratio. I've provided some reasonable defaults; just type over them with your own values.

Weight:	175	pounds
Cadence:	60	RPM
Power:	200	Watts
Grade:	10	percent

Crank!

You'll need:	31.2380	gear inches.
You'll be moving at:	5.57316	miles per hour.

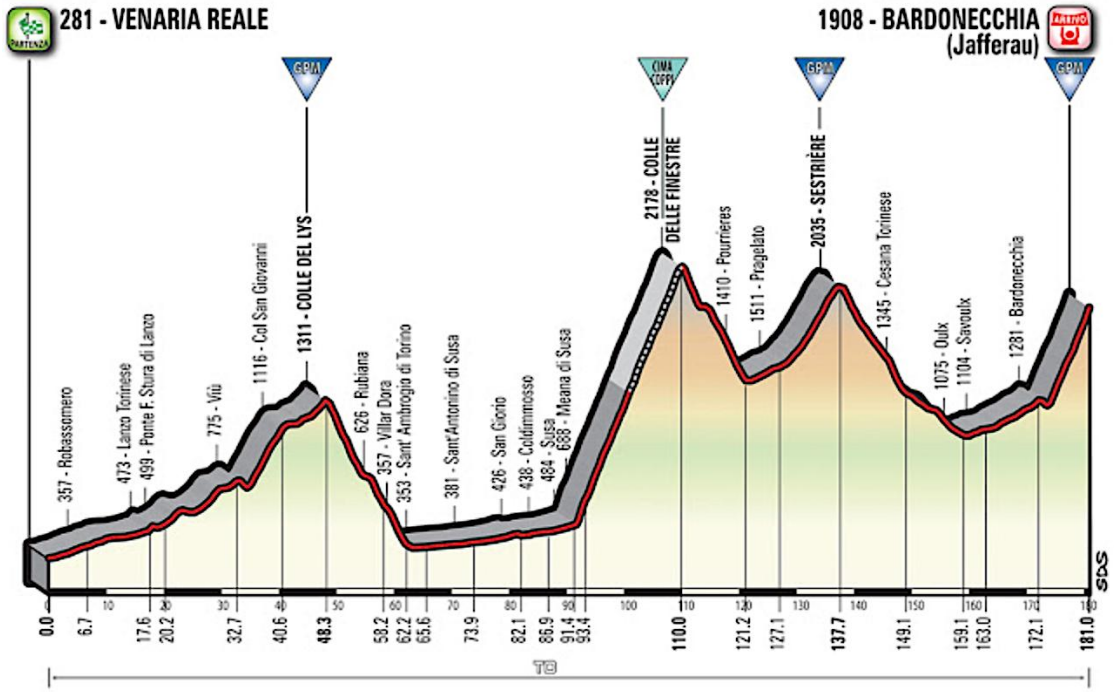
This next calculator takes your wheel size, chainring size, and freewheel size and computes the gear ratio.

Wheel size:	27	inches
Chainring:	50	teeth
Freewheel:	15	teeth

Crank!

Gear ratio:	90	gear inches

http://sdellington.us/gearing/gearing.html


281 - VENARIA REALE
1908 - BARDONECCHIA (Jafferau)
GPM
CIMA COPPI
357 - Robassomero
473 - Lanzo Torinese
499 - Ponte F. Stura di Lanzo
775 - Viù
1116 - Col San Giovanni
1311 - COLLE DEL LYS
626 - Rubiana
357 - Villar Dora
353 - Sant' Ambrogio di Torino
381 - Sant'Antonino di Susa
426 - San Giorio
438 - Coldimmosso
484 - Susa
688 - Meana di Susa
2178 - COLLE DELLE FINESTRE
1410 - Pourrieres
1511 - Pragelato
2035 - SESTRIÈRE
1345 - Cesana Torinese
1075 - Oulx
1104 - Savoulx
1281 - Bardonecchia
0.0
6.7
17.6
20.2
32.7
40.6
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82.1
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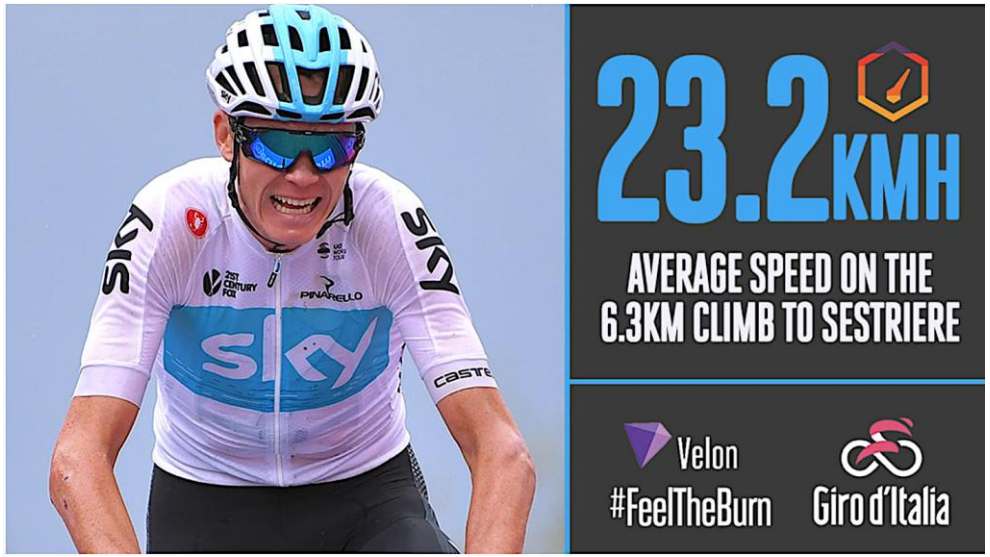
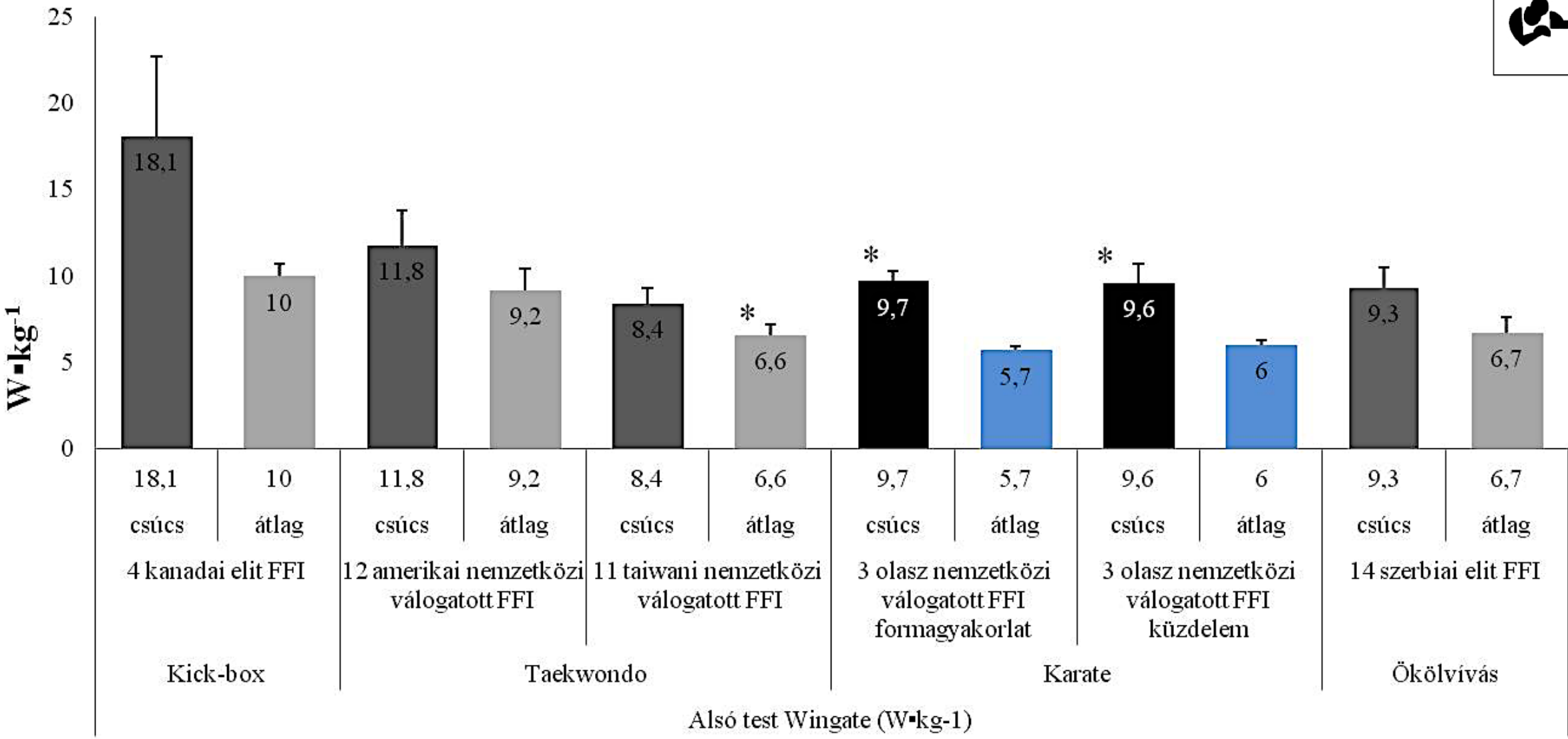
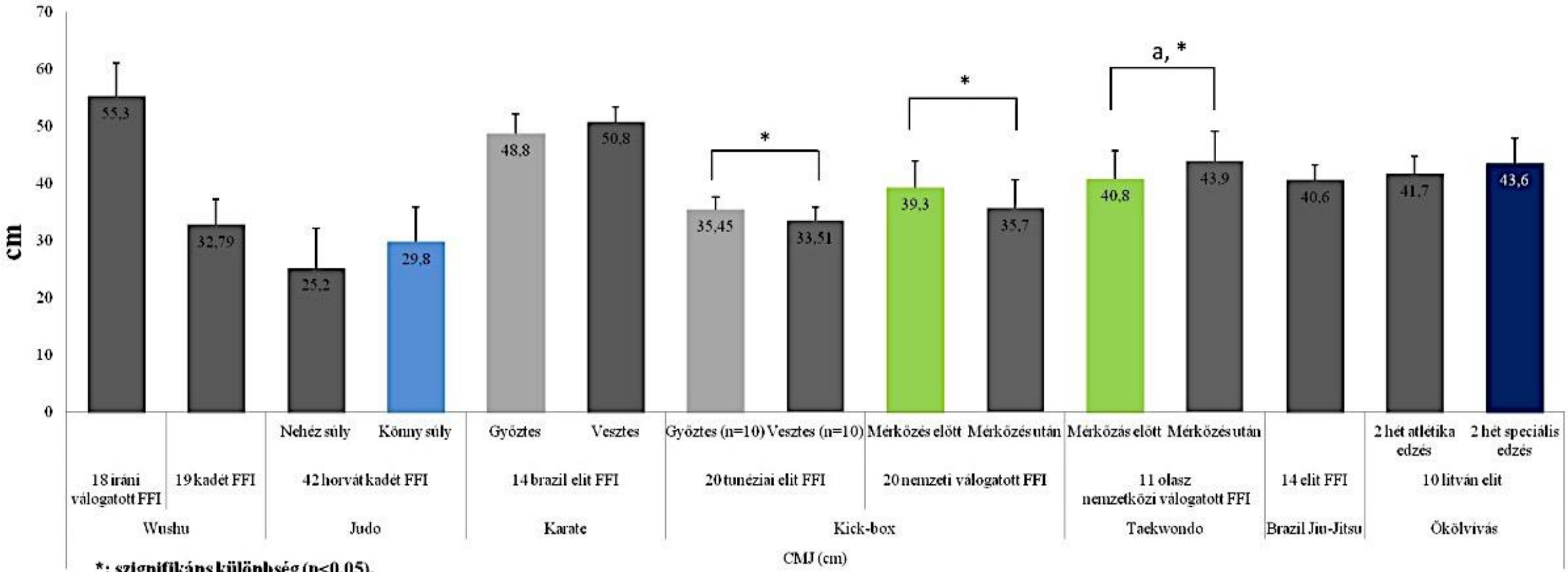

23.2KMH
AVERAGE SPEED ON THE 6.3KM CLIMB TO SESTRIERE
Velon
#FeelTheBurn
Giro d'Italia

veloncc
450,000
PEDAL STROKES
3,572.4
KILOMETRES RIDDEN
50,258
METRES CLIMBED
40.1KMH
AVERAGE SPEED
CHRIS FROOME
Velon
#FeelTheBurn
TEAM SKY
Giro d'Italia
264 likes
veloncc 🔥 @teamsky's @chrisfroome rode #Giro101 at an average speed of 40.1km/h making it one of the... more



Brédl, Sáfár (2018)



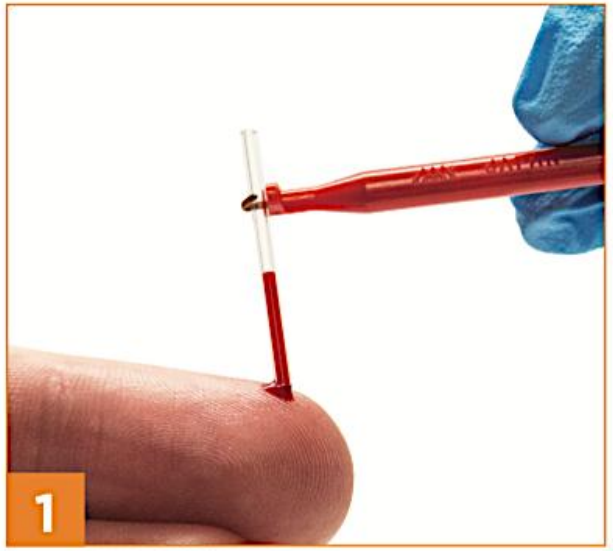
Brédl, Sáfár (2018)

Kajak-kenu sportág intenzitási viszonyai a hajó sebessége alapján

Intenzitás	200m		500m		1000m	
	sebesség	%	sebesség	%	sebesség	%
100	5.10	100	4.85	100	4.40	100
95	4.96	97	4.70	97	4.25	97
90	4.79	94	4.55	94	4.10	93
85	4.62	91	4.37	90	3.95	90
80	4.46	88	4.20	87	3.76	85
75	4.28	84	4.03	83	3.58	81
70	4.09	80	3.84	79	3.35	76

Catalog No.	Name
5213-0051-6200	• Biosen C-Line GP+ (1 measuring channel)
5213-0121-6200	• Biosen C-Line GP+ (2 measuring channels)
5214-0051-2200	• Biosen C-Line Clinic (1 measuring channel)
5214-0121-2200	• Biosen C-Line Clinic (2 measuring channels)
5222-0056-6200	• Biosen S-Line Lab+ (1 measuring channel)
5222-0123-6200	• Biosen S-Line Lab+ (2 measuring channels)

Biosen S-Line Lab+



Collect 20 µl blood sample in capillary.

Place capillary into cup and invert until mixed.

Result in 20–45 seconds.

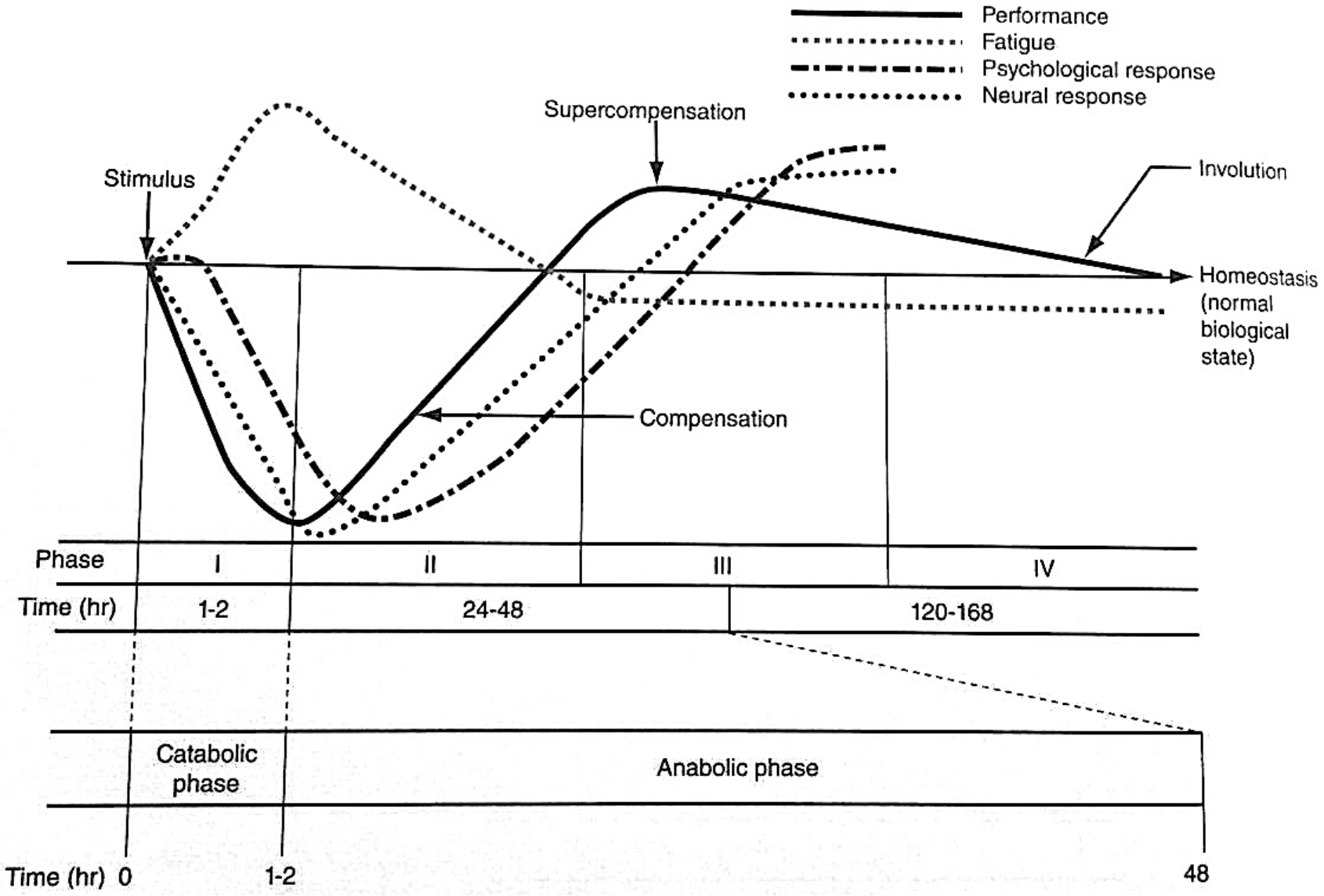
Michael és mtsai (2008) tudományos összegzése az ergométeren és kajak versenyszám közben leadott mért laktát szint összefoglalására

Publikációk	Vizsgálati személyek	Ergométer (mM)			Kajak	
		Láb	Kar	Kajak	500 m	1000 m
Sidney és Shephard (1973)	10 elit kajakos	14,1				
Tesh és mtsai (1976)	6 elit kajakos				13,2	12,9
Tesch (1983)	6 elit kajakos	14,2	13,5	14,0		13,0
Pendergast és mtsai (1989)	17 kajakos					12,0
Bishop és mtsai (2002)	8 kiváló kajakos					

Michael és mtsai (2008) tudományos összegzése a különböző sportágakban mért VO_2max értékek összefoglalására

Sport	Publikációk	VO_2 max abszolút (L•min-1)	VO_2 max relatív (L•min-1)	Energia és sebesség VO_2 max pillanatában
Kajak	Tesch (1983)	4,70	58,80	
	Hahn és mtsai (1988)	4,62	58,50	
	Fry és Morton (1991)	4,78	58,90	
	Billat és mtsai (1996)	4,01	53,80	239 W
Kenu	Hahn és mtsai (1988)	3,49	44,20	
	Bunc és Heller (1991)	4,17	51,90	
Evezés (kb. 85 kg)	Di Prampero és mtsai (1971)	5,00	58,80	
	Secher (1990)	6,00	68,20	
	Lakomy és Lakomy (1993)	4,80	60,00	
Úszás (400 m)	Billat és mtsai (1996)	4,41	59,60	1,46 m•s $^{-1}$
	Lavoie és mtsai (1981)	4,31	58,40	
	Roels és mtsai (2005)	5,60	58,40	
Országúti kerékpár	Billat és mtsai (1996)	5,61	72,40	419 W
	Lee és mtsai (2002)	5,45	73,00	
	Lucia és mtsai (1999)	5,10	74,00	
Futás (3000 m)	Billat és mtsai (1996)	5,11	74,90	6,22 m•s $^{-1}$
	Draper és Wood (2005)	5,00	68,90	
	Caputo és Denadai (2004)	6,30	68,80	

Egy edzés terhelésének szerkezeti elemei, a szuperkompenzáció bázisa



CK szint alakulása a terhelést megelőzően és azt követő mintavételben (IP) (+24, 48 óra)

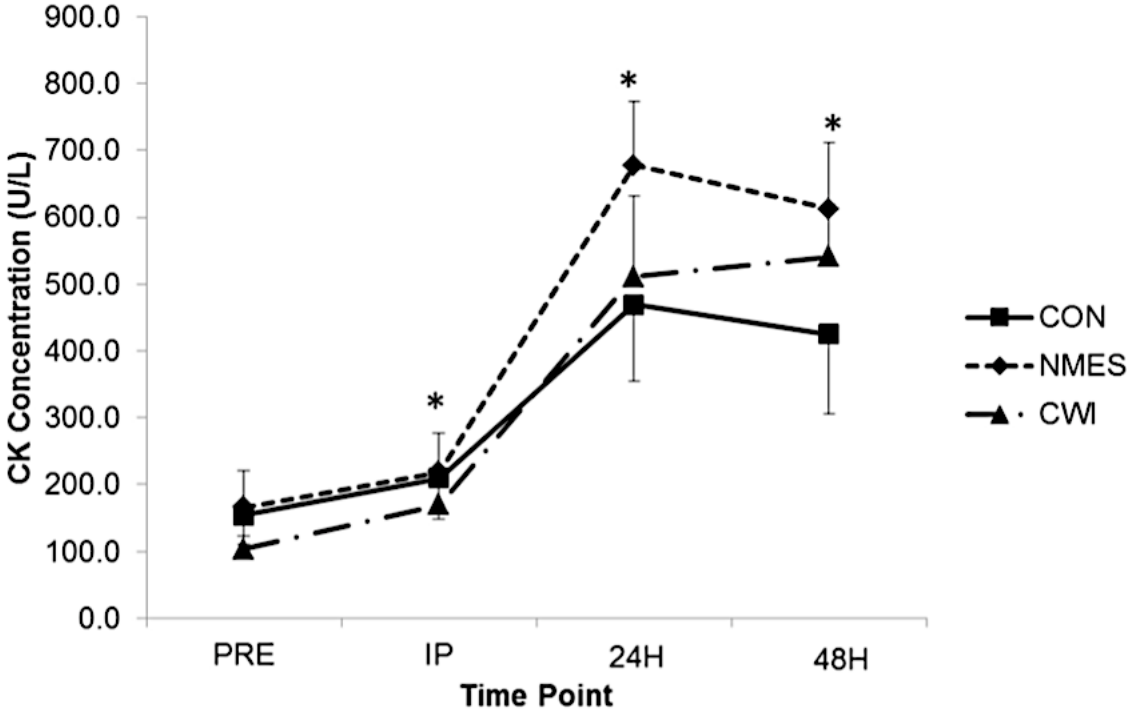


Figure 1 — Changes in creatine kinase (CK) concentration on the first day of training from preexercise (PRE) to immediately postexercise (IP) and 30 minutes postexercise (30P) on the first day of training and to preexercise on the second (24H) and third (48H) days of training in neuromuscular electrical stimulation (NMES), cold-water immersion (CWI), and control (CON) groups. *Significant elevation from PRE for all groups combined ($P < .001$).

Jajtner és mtsai (2015)

JOURNAL OF SPORTS SCIENCES, 2015
http://dx.doi.org/10.1080/02640414.2015.1106574

Routledge
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Quantification of training load during one-, two- and three-game week schedules in professional soccer players from the English Premier League: implications for carbohydrate periodisation

Liam Anderson[a,b], Patrick Orme[a,b], Rocco Di Michele [c], Graeme L Close[b], Ryland Morgans[a], Barry Drust[a,b] and James P Morton[a,b]

[a]Liverpool Football Club, Melwood Training Ground, Liverpool, UK; [b]Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, UK; [c]Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy

ABSTRACT

Muscle glycogen is the predominant energy source for soccer match play, though its importance for soccer training (where lower loads are observed) is not well known. In an attempt to better inform carbohydrate (CHO) guidelines, we quantified training load in English Premier League soccer players (n = 12) during a one-, two- and three-game week schedule (weekly training frequency was four, four and two, respectively). In a one-game week, training load was progressively reduced ($P < 0.05$) in 3 days prior to match day (total distance = 5223 ± 406, 3097 ± 149 and 2912 ± 192 m for day 1, 2 and 3, respectively). Whilst daily training load and periodisation was similar in the one- and two-game weeks, total accumulative distance (inclusive of both match and training load) was higher in a two-game week (32.5 ± 4.1 km) versus one-game week (25.9 ± 2 km). In contrast, daily training total distance was lower in the three-game week (2422 ± 251 m) versus the one- and two-game weeks, though accumulative weekly distance was highest in this week (35.5 ± 2.4 km) and more time ($P < 0.05$) was spent in speed zones >14.4 km · h^{-1} (14%, 18% and 23% in the one-, two- and three-game weeks, respectively). Considering that high CHO availability improves physical match performance but high CHO availability attenuates molecular pathways regulating training adaptation (especially considering the low daily customary loads reported here, e.g., 3–5 km per day), we suggest daily CHO intake should be periodised according to weekly training and match schedules.

ARTICLE HISTORY
Accepted 7 October 2015

KEYWORDS
Carbohydrate; glycogen; high intensity; periodization

Quantification of training load during one-, two- and three-game week schedules in professional soccer players from the English Premier League: implications for carbohydrate periodisation

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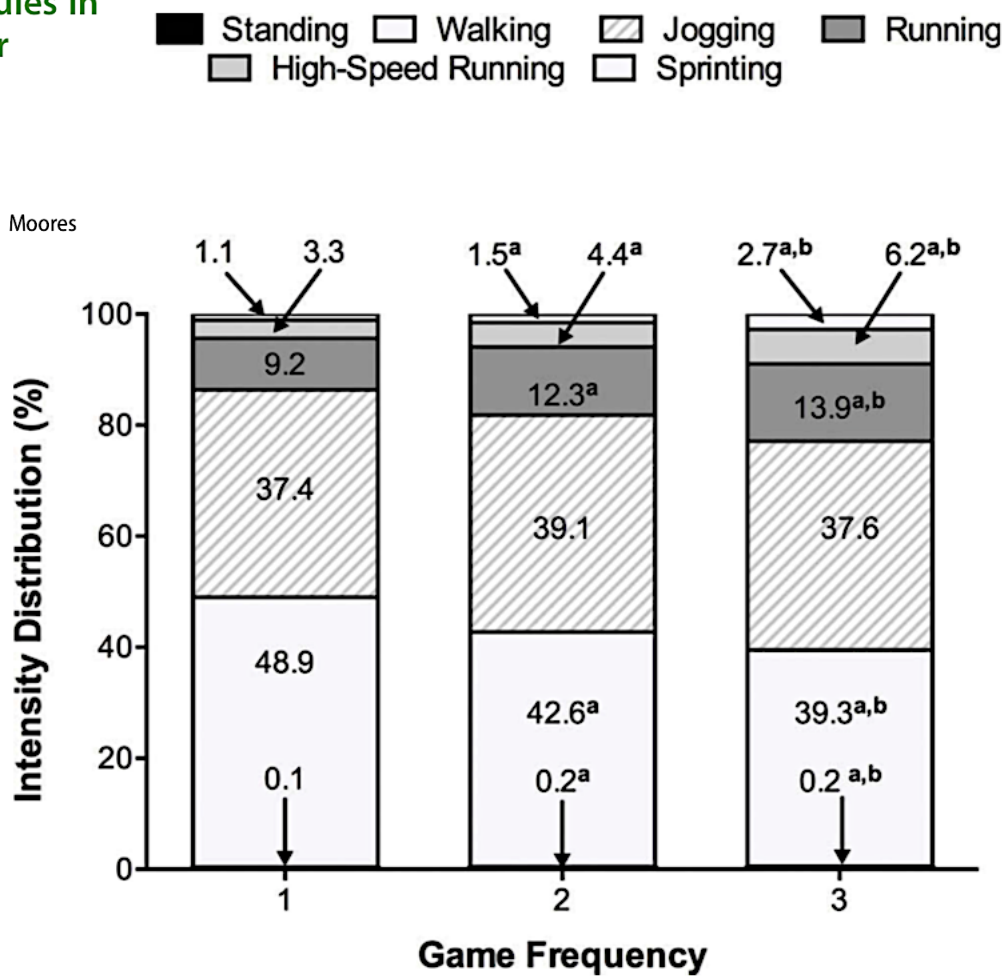


Figure 3. Intensity distribution expressed as percentage of distance completed within each speed zone. Numbers inset represent actual percentage values. [a] denotes difference from one-game week, [b] denotes difference from two-game week, all $P < 0.05$.

Két elit brazil labdarúgó nyomon követése 3 hetes periódus alatt (3 mérkőzés)

	Age (years)	Years as professional	Position	% body fat	VO_2max mL.(Kg.min)$^{-1}$
Athlete 1	26	7	Mid-fielder	10,1	60,8
Athlete 2	19	1	right back	10,6	62,3

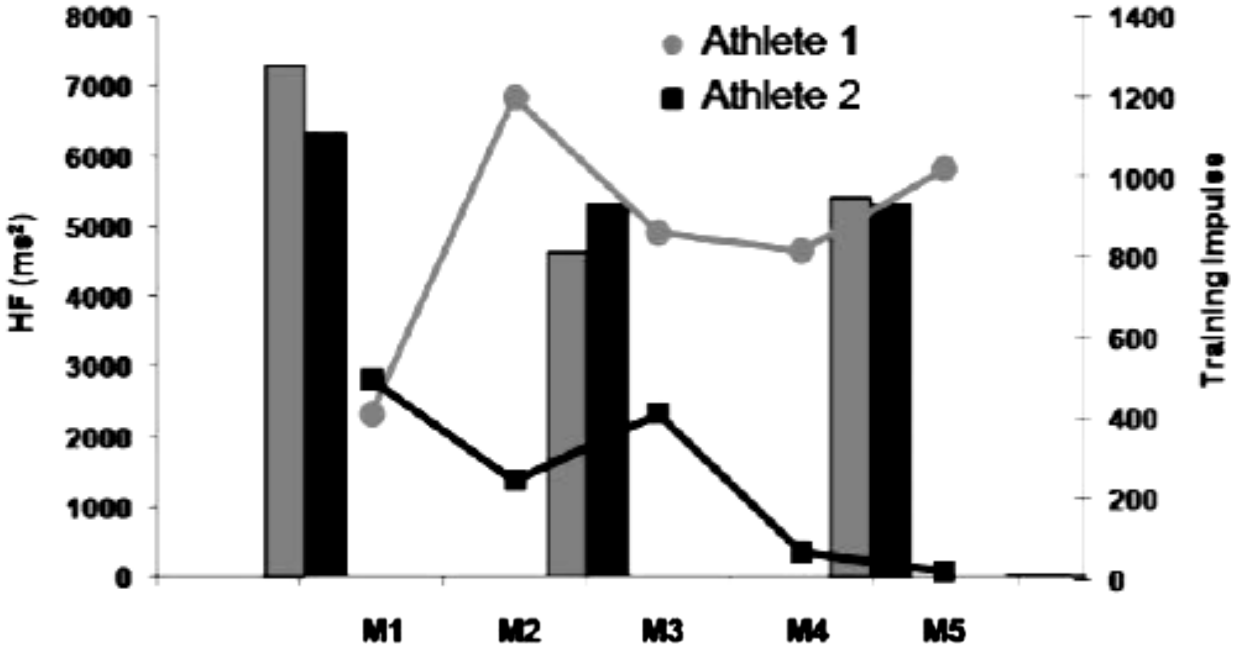
Bara-Filho és mtsai (2013)

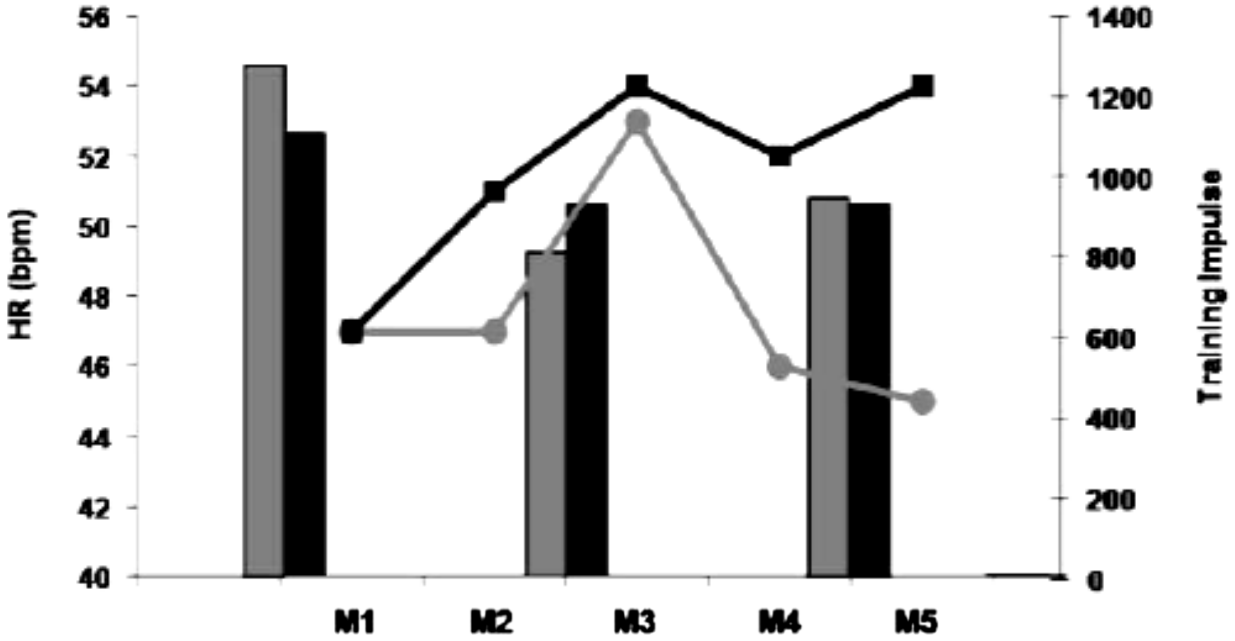
HRV mérése: Polar RS800
Mérési frekvencia: 5 mp
Edzés célok: Zömében kis játékok, mérkőzés szituációkra, erősítés, sprint edzés, LI aerob edzés.
Frekvencia: egy vagy két alkalommal/nap (összesen 5x egy héten)
Szombat: mérkőzés
Vasárnap: pihenő
Mind a két labdarúgó kezdő volt mind a három mérkőzésen.

Nyugalmi RR intervals mérési időpontok:

- **M1 (Szombat),**
- **M2 (Hétfő),**
- **M3 (Szombat),**
- **M4 (Hétfő)**
- **M5 (Szombat).**

Két elit brazil labdarúgó nyomon követése 3 hetes periódus alatt (3 mérkőzés)





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Bara-Filho és mtsai (2013)

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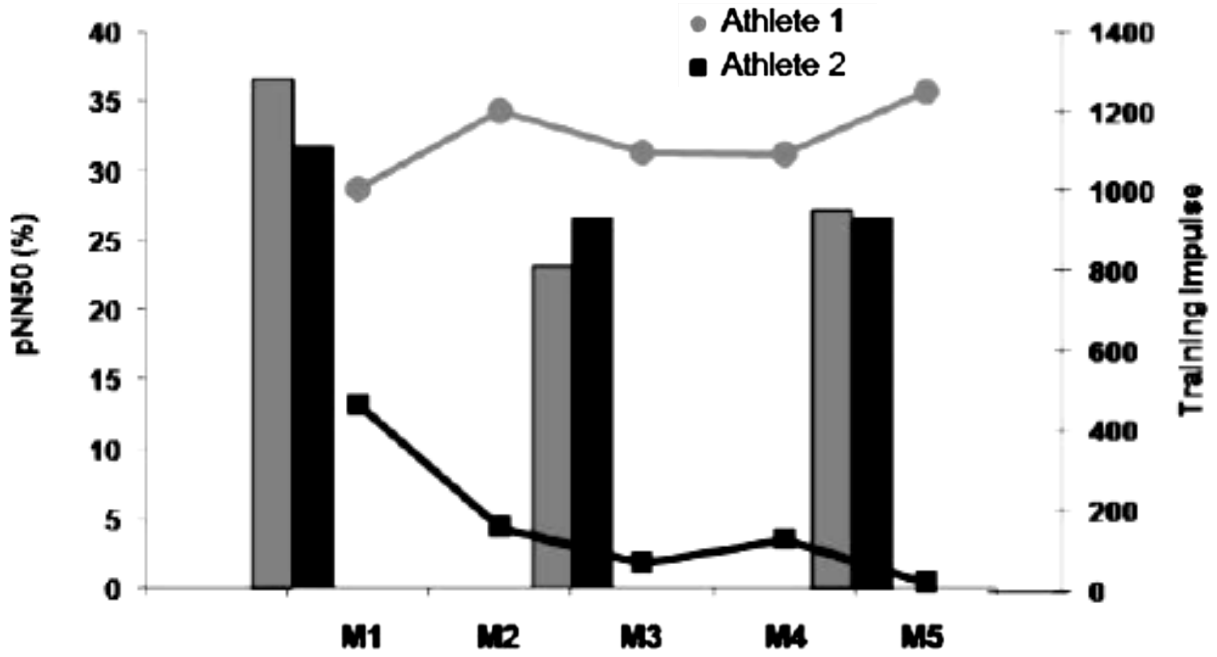

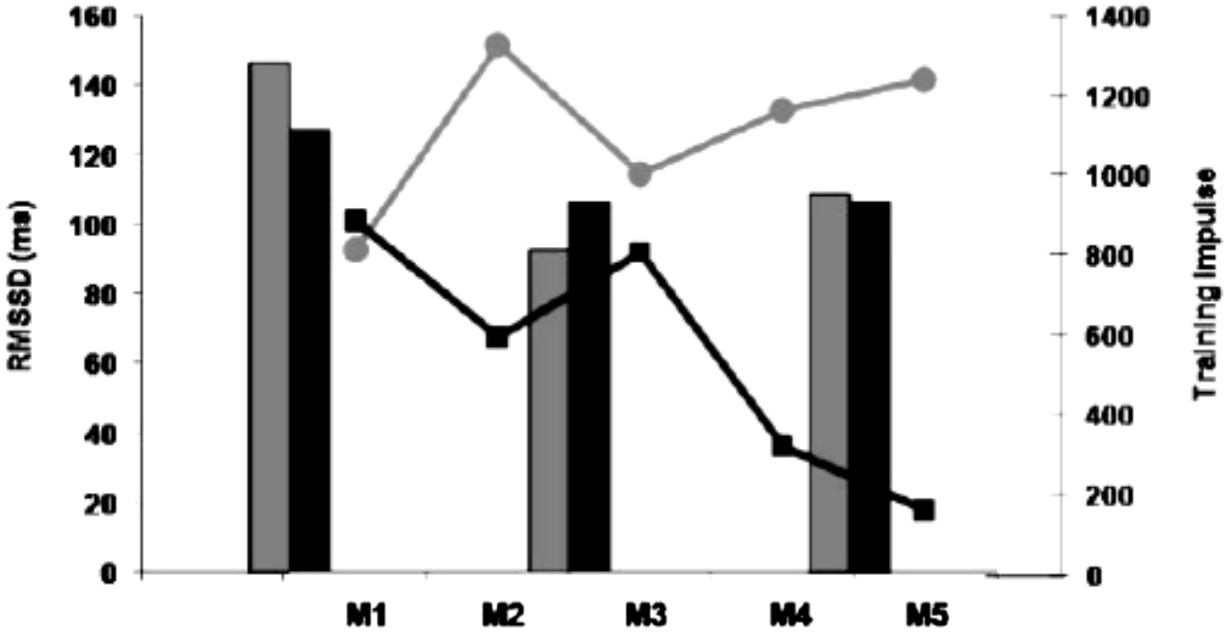

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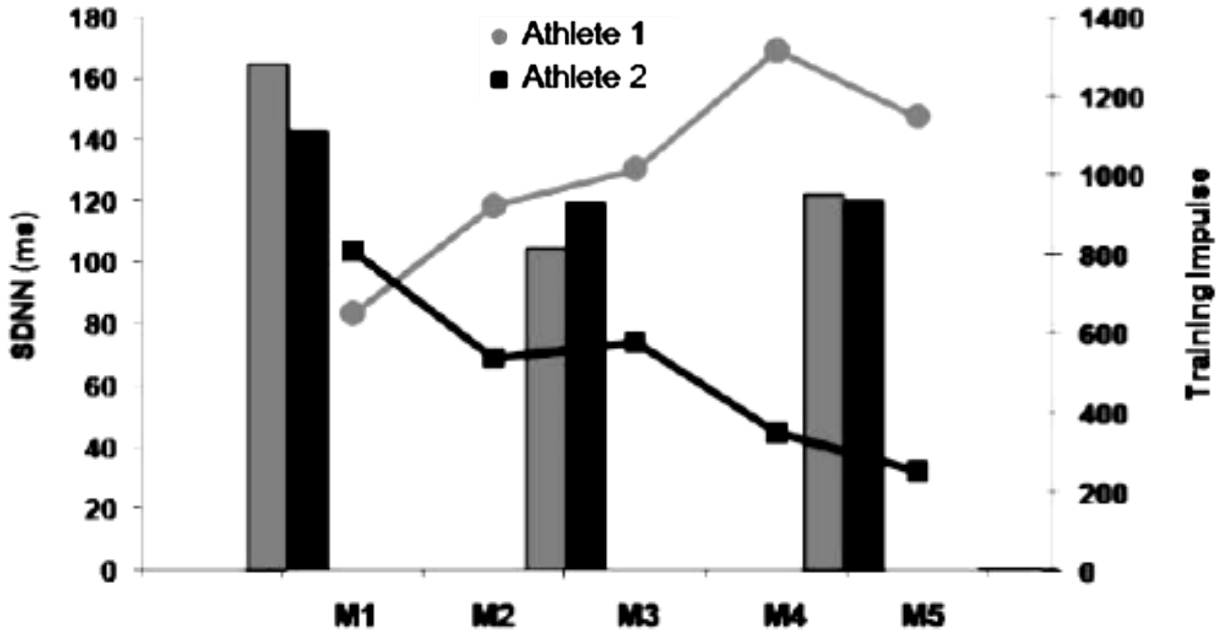
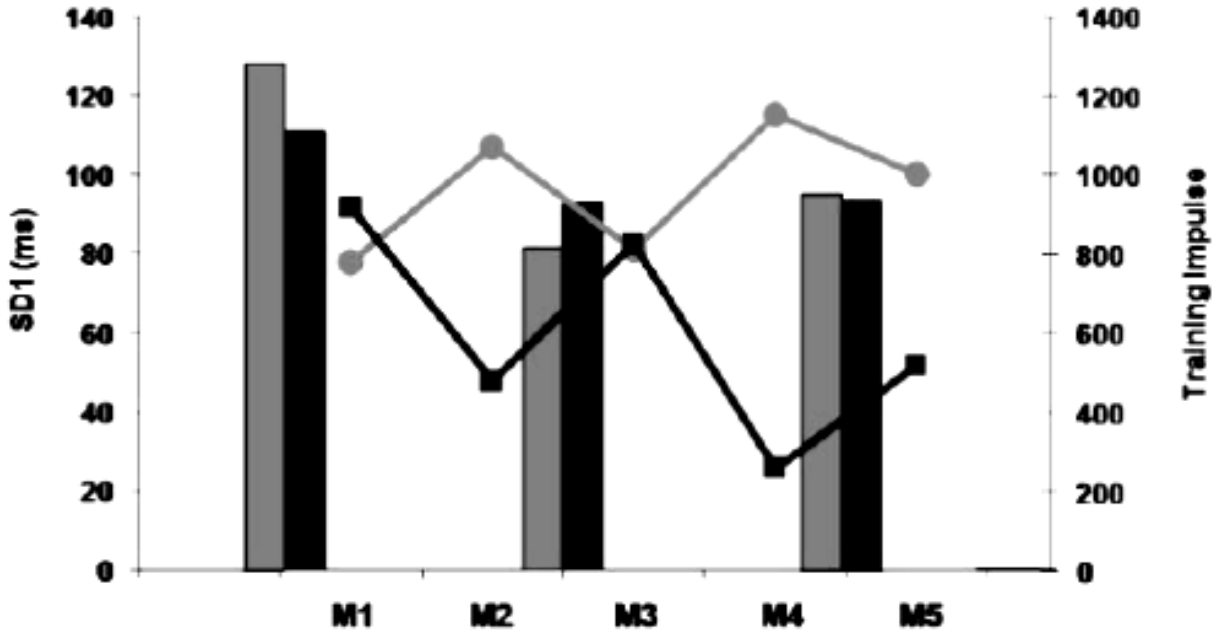
Bara-Filho és mtsai (2013)

Két elit brazil labdarúgó nyomon követése 3 hetes periódus alatt (3 mérkőzés)





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Bara-Filho és mtsai (2013)

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Tour de France-Stage 7 Tomblaine - La Planche des Belles Filles 199km

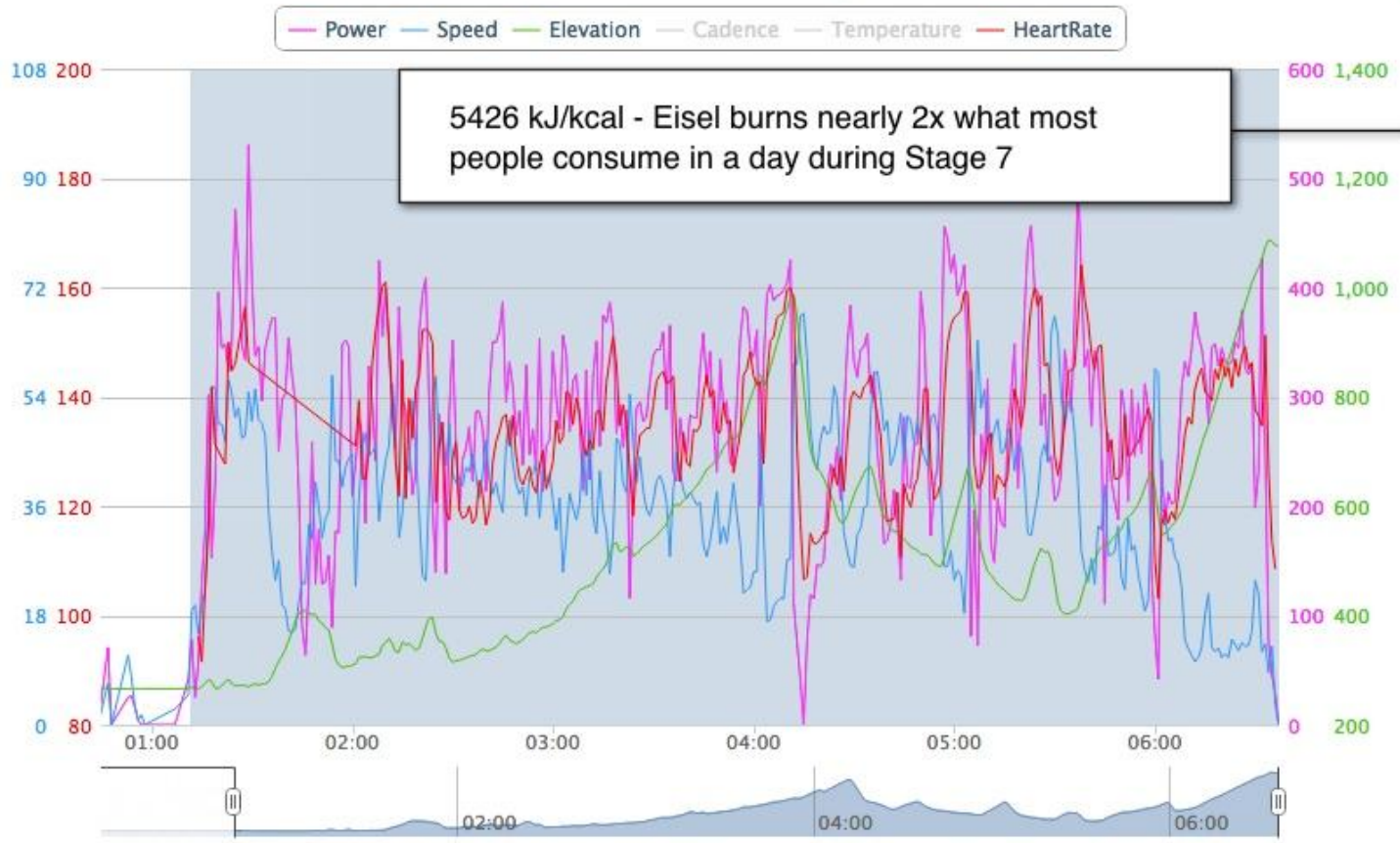
Saturday, July 07, 2012 : Bike

by Bernie Eisel

Share 0 +1 0 Tweet 0

Duration	Distance	TSS™
5:31	199.7	332
hh:mm	km	points

Graph



Stage 7
1:11:48 - 6:37:10

Total Time:	5:25:22
Moving Time:	5:25:17
Distance:	199.05 km
Energy:	5426 kJ
TSS:	328 (0.78)
NP:	323
VI:	1.16
Pw:HR	3.85%
EF:	2.41
Gain:	2251 m
Loss:	- 1441 m
Grade:	0.4 %
VAM:	415
W/Kg:	3.5

	Min	Avg	Max
Power (Watts):	0	278	1142
Speed (km/h):	0.0	36.7	78.6
Pace (min/km):	99:99	01:38	00:46
HR (bpm):	81	134	166
Cadence (rpm):	0	83	144
Elev (m):	263	523	1089
Temp (C):	25	31	40

Learn More

Athlete & Coach comments

Bernie Eisel, Thursday, July 12, 2012

1 Christopher Froome (GBr) Team Sky 4:58:35

Lap		
Total	199.67 km	5:31:34 (6:37:09)
▶ Stage 7	199.05 km	5:25:17 (5:25:22)

Andy Schleck Tour de France 2011, második összetettben
„Vacsora”

Poszt-specifikus táplálékbevitel professzionális labdarúgóknál a felkészülés alatt

Table 2. Energy, macronutrient intake and prevalence of adequacy according to the team positions.

	Team position						
Variables	Midfielders Mean ± SD	Goalkeepers Mean ± SD	Forwards Mean ± SD	Full-backs Mean ± SD	Sides Mean ± SD	Team Mean ± SD	Recommendations[a]
Energy (kcal/kg/day)	44.29 ± 16.84	39.59 ± 7.20	39.44 ± 9.18	38.52 ± 12.85	34.04 ± 5.81	40.74 ± 12.81	30–50 kcal/kg
%	110.73	98.97	98.61	96.29	85.10	101.84	
Protein (g/kg/day)	2.28 ± 0.96	1.79 ± 0.69	1.41 ± 0.23	1.83 ± 0.45	1.45 ± 0.50	1.91 ± 0.75	1.2–1.7 g/kg
%	239.58	188.48	148.01	192.22	153.14	200.67	
Carbohydrate (g/kg/day)	5.59 ± 2.17	5.60 ± 1.15	5.46 ± 1.41	5.49 ± 2.71	4.52 ± 0.37	5.44 ± 1.86	5–10 g/kg
%	74.53	74.64	72.82	73.19	60.31	72.50	
Total fibre (g/day)	24.32 ± 7.74	22.35 ± 4.29	25.78 ± 3.38	24.16 ± 8.96	29.71 ± 9.52	24.88 ± 6.91	25 g/day
%	97 ± 31	89 ± 17	103 ± 13	97 ± 36	119 ± 39	99 ± 28	
Fat (g/kg/day)	1.42 ± 0.64	1.15 ± 0.01	1.37 ± 0.53	1.02 ± 0.41	1.18 ± 0.28	1.27 ± 0.50	1 g/kg
%	141.63	114.53	136.63	101.98	117.70	127.12	
SFA	8.69	7.84	9.37	7.01	11.12	8.61	< 10% of total energy
%	86.90	78.41	93.67	70.13	111.23	86.11	
PUFA	9.00 ± 7.39	9.80 ± 1.73	13.12 ± 4.40	8.42 ± 4.25	9.63 ± 0.95	9.70 ± 5.40	10% of total energy
%	25.03	26.80	45.15	26.74	36.72	29.98	
MUFA	23.82 ± 13.41	26.71 ± 0.01	32.33 ± 16.63	17.23 ± 9.51	25.74 ± 10.99	24.27 ± 12.05	10% of total energy
%	69.99	72.48	104.07	59.65	95.60	76.15	
Cholesterol (mg/day)	359.56 ± 154.93	374.04 ± 142.07	285.89 ± 52.97	326.77 ± 76.44	280.51 ± 100.16	334.23 ± 116.11	< 300 mg/day
%	119.85	124.68	95.30	108.92	93.50	111.41	

SFA: Saturated fatty acids, PUFA: Polyunsaturated fatty acids, MUFA: Monounsaturated fatty acids. %: Prevalence of adequacy. SFA, PUFA and MUFA intake are referred as percentage of total energy intake.
[a]*Source*: Hernandez and Nahas, 2009.

Raziel és mtsai (2017)

Célirány: Labdarúgók táplálkozása az edzések és mérkőzéseket megelőzően

Pre-training and matches	CHO: 1–4 g/kg	Adjust according to the session needs and individual tolerance; Choose lower range if restricting calories.	[69,70]
	Protein: 0.25–0.4 g/kg	Choose an amount near the higher range when in a low energy budget and/or before resistance training.	[71]
	Hydration: ~5–7 mL/kg—at least 4 h before the exercise task. If urine is not produced, or urine is dark or highly concentrated: ~3–5 mL/kg—about 2 h before the event.	Enhancing palatability of the ingested fluid will help to promote fluid consumption. The preferred water temperature is often between 15 and 21 °C.	[72]

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Oliveira és mtsai (2017)

Célirány: Labdarúgók táplálkozása az edzések alatt

During training	CHO	Light training: no need, provided sufficient pre-training HCO was consumed.		[70,73]
		Hard training/Two sessions a day: 30–60 g/kg	Provide the highest amount when performing an afternoon session <8 h after hard morning session; consider the addition of a small amount of protein to the CHO solution.	
	Hydration: sufficient fluids must be consumed to avoid (a) losing more than 2% of initial BW and (b) weight gain.		Athletes must be aware their sweat rates. The addition of small amounts of salt must be considered during prolonged training sessions in the heat.	[72]

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Oliveira és mtsai (2017)

Célirány: Labdarúgók táplálkozása az edzéseket követően

After training	CHO	Light training: follow food plan to ensure daily needs are met		[16,73,74]
		Hard training/Two sessions a day: 1.0–1.2 g CHO/kg/h	Start refueling immediately after training; check for individual glycemic response to ensure high CHO availability.	
		Protein: 0.25–0.4 g/kg	Choose an amount near the higher range after high intensity and/or resistance training.	[71]
		Hydration: ingest 125–150% of fluids lost.	Salty foods and drinks may help retaining ingested water. Drink regularly rather than one large bolus.	[12]

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Oliveira és mtsai (2017)

Célirány: Labdarúgók táplálkozása a mérkőzések alatt

During competition	CHO: 30–60 g/h or small amounts or mouth rinsing if the athlete is going to compete for a short amount of time (30 min–1 h).	Small sips or rinsing of sports drinks. Test in training before practicing in matches.	[16,73]
	Hydration: ad libitum	Especially relevant when pre-match hydration status is inadequate.	[72]

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Oliveira és mtsai (2017)

Célirány: Labdarúgók táplálkozása a mérkőzéseket követően

After competition	CHO	72 h or less until next match: 1–1.2 g CHO/kg/h OR 0.8 g CHO/kg plus 0.4 g protein/kg/h		[16,70]
		More than 72 h until next match: ad libitum, provided daily needs are met		
		Private events, single matches: ad libitum	Eat and drink taking into account individual nutrition and body composition goals and the next competitive commitments.	
	Protein: similar to post-training			[71]
	Hydration: ad libitum			[12]

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Oliveira és mtsai (2017)

A folyadékbevitel fontos!

Review

Nutrition and Supplementation in Soccer

César Chaves Oliveira [1,*], Diogo Ferreira [2], Carlos Caetano [2], Diana Granja [2], Ricardo Pinto [2], Bruno Mendes [2] and Mónica Sousa [3]

Folyadékbevitel a labdarúgásban!

Table 2. Sweat losses, sweat rates and intake recommendations for an adequate hydration in soccer.

N	Environmental Conditions	Duration	Mean Sweat Losses (mL)	Sweat Rates (mL/h)	Fluid Intake (mL)	Dehydration (% BML)	Reference
			Training sessions				
24 PP	T: 24–49 °C RL: 46–64%	90 min	2033 ± 413	1355 ± 275	971 ± 303	1.37 ± 0,54	[136]
26 PP	T: 32 ± 3 °C RL: 20 ± 5%	90 min	2193 ± 365	Not reported	972 ± 335	1.59 ± 0.61	[135]
17 PP	T: 5 ± 0.7 °C RL: 81 ± 6%	100 min	1690 ± 450	1130 + 300	423 ± 215	1.62 ± 0.55	[137]
			Match play (including simulation)				
17 PP	T: 35 ± 1 °C RH: 35 ± 4	90 min	4448 ± 1216	1483 + 362	1948 ± 954	3.4 ± 1.1	[132]
13 PP	T: 27 ± 0.1 °C R: 65 ± 7%	100 min	2600 ± 600	Not reported	1666 ± 333	3.4 ± 0.7	[138]
20 PP	T: 6–8 °C RL: 50–60%	90 min	1680 ± 400	Not reported	840 ± 470	1.1 ± 0.6	[129]
20 PP	T: 29 ± 1.1 °C RH: 64 ± 4.2%.	90 min	2360 ± 530	866 ± 319	1265.00 ± 505.45	1.35 ± 0.87	[139]

PP: professional players; T: environmental temperature; RL: Relative humidity.

Oliveira és mtsai (2017)

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