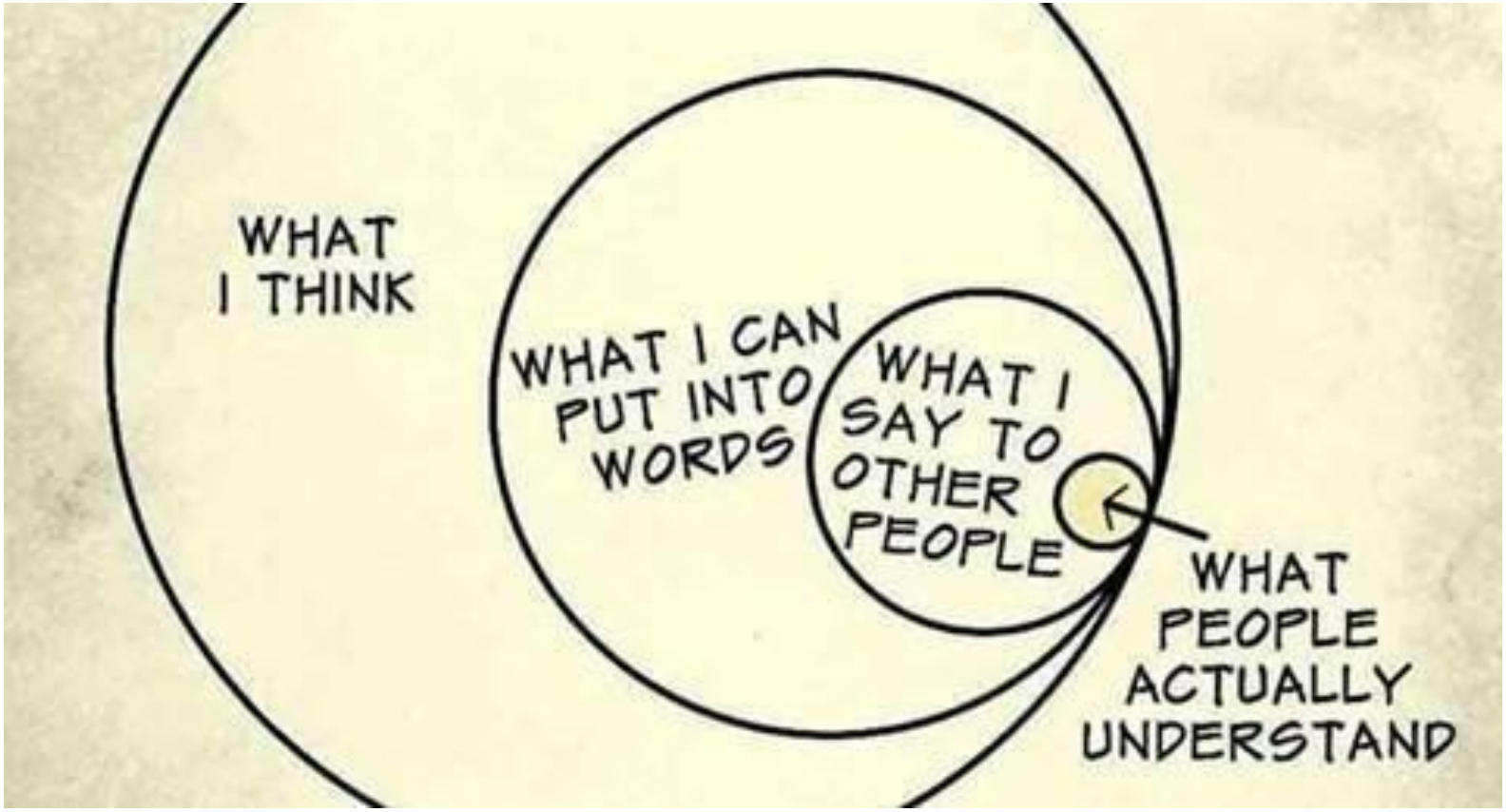
Préambule

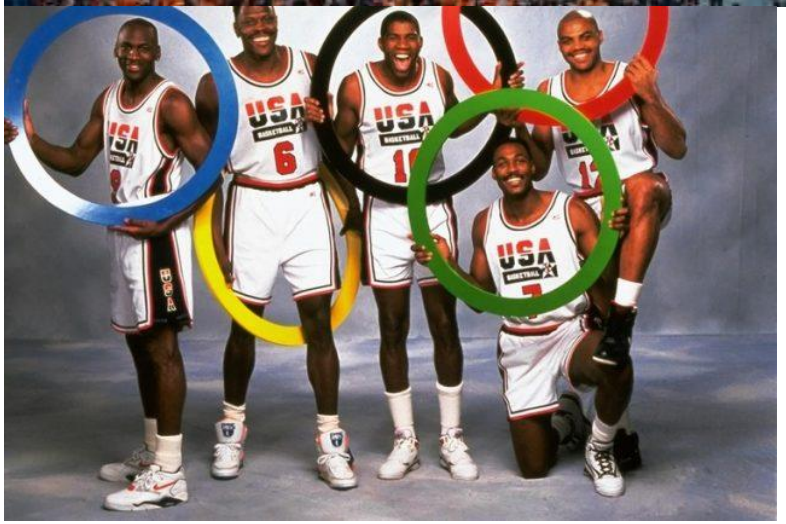


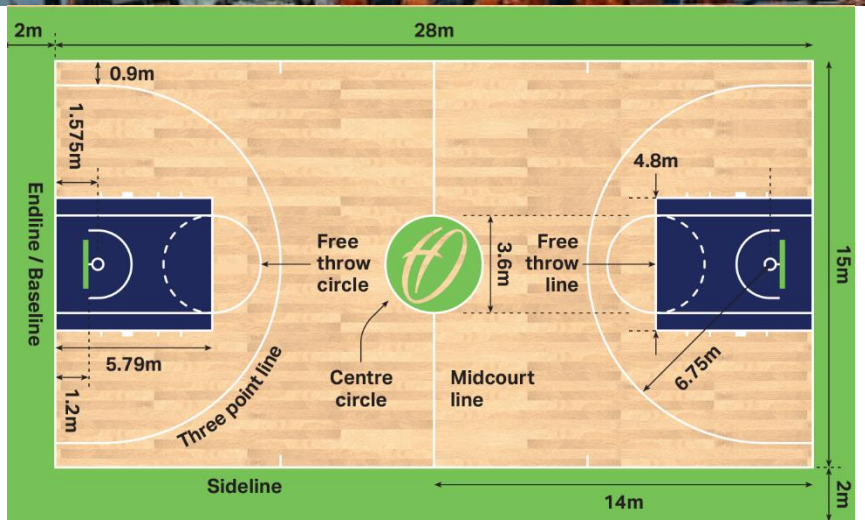
UE 64.3.B

Can we go faster to the basket with hip thrust?

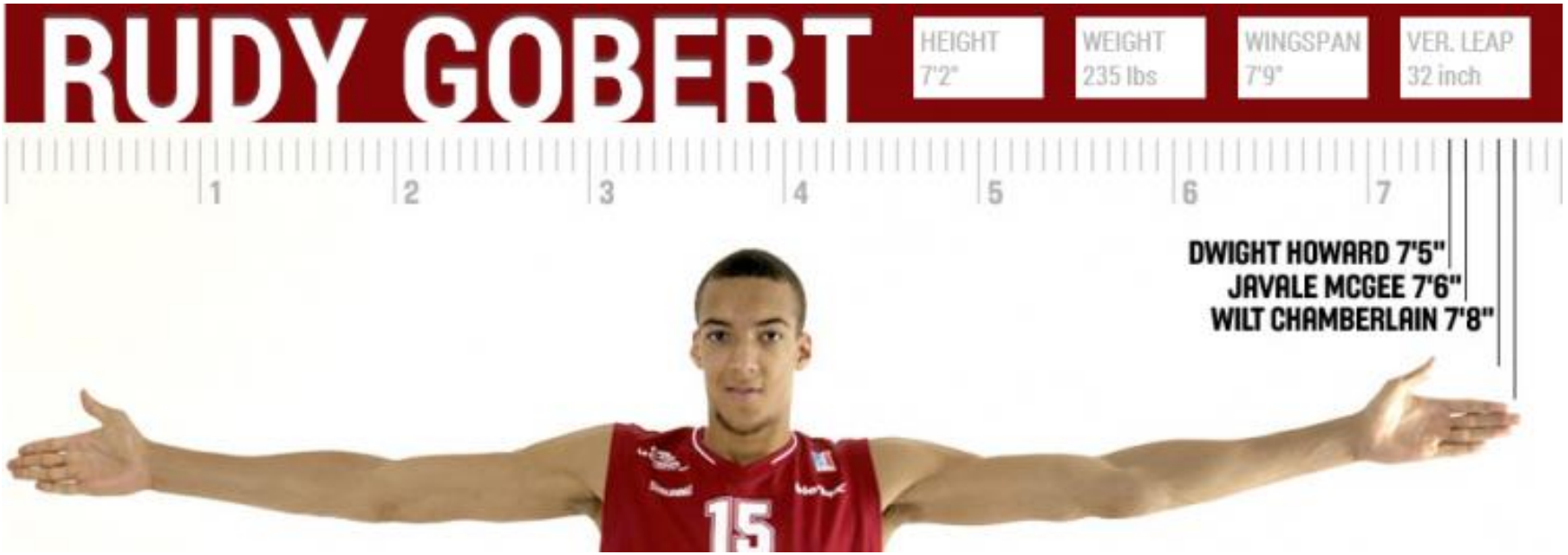
Besson P, Brioche T, Mortel L, Perrey S, Py G, Sorgato D & Vidal J

Basketball


USA
USA
USA
USA


2m
28m
0.9m
1.575m
4.8m
Endline / Baseline
Free throw circle
3.6m
Free throw line
15m
5.79m
1.2m
Three point line
Centre circle
Midcourt line
6.75m
Sideline
14m
2m

Anthropometric evolution



Wingspam changes from 1997-2016	
PG	+ 2,3 cm
SG	+ 2,3 cm
SF	+ 2,6 cm
PF	+ 2,0 cm
C	- 0,7 cm

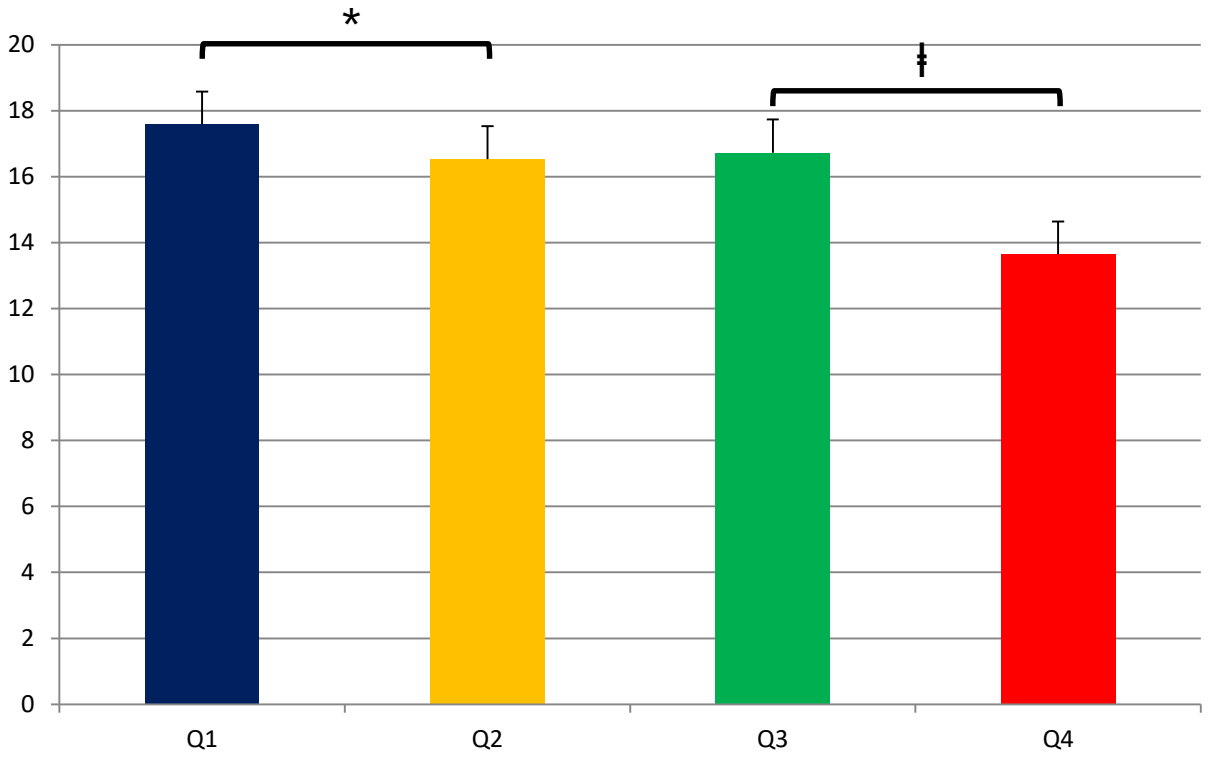
2017 Bach, C. W., & Ransone, J. W. Anthropometric Evolution Of Professional Basketball Positions: A 20-year Retrospective View Of NBA Players. *Medicine & Science in Sports & Exercise*.

Anthropometric evolution

More density → Less time → Need to go faster

2022 Irani, A. The Effect Density Has on the Speed of Light, Time, and the Dimensions of the Multiverse. *Journal of High Energy Physics, Gravitation and Cosmology*.

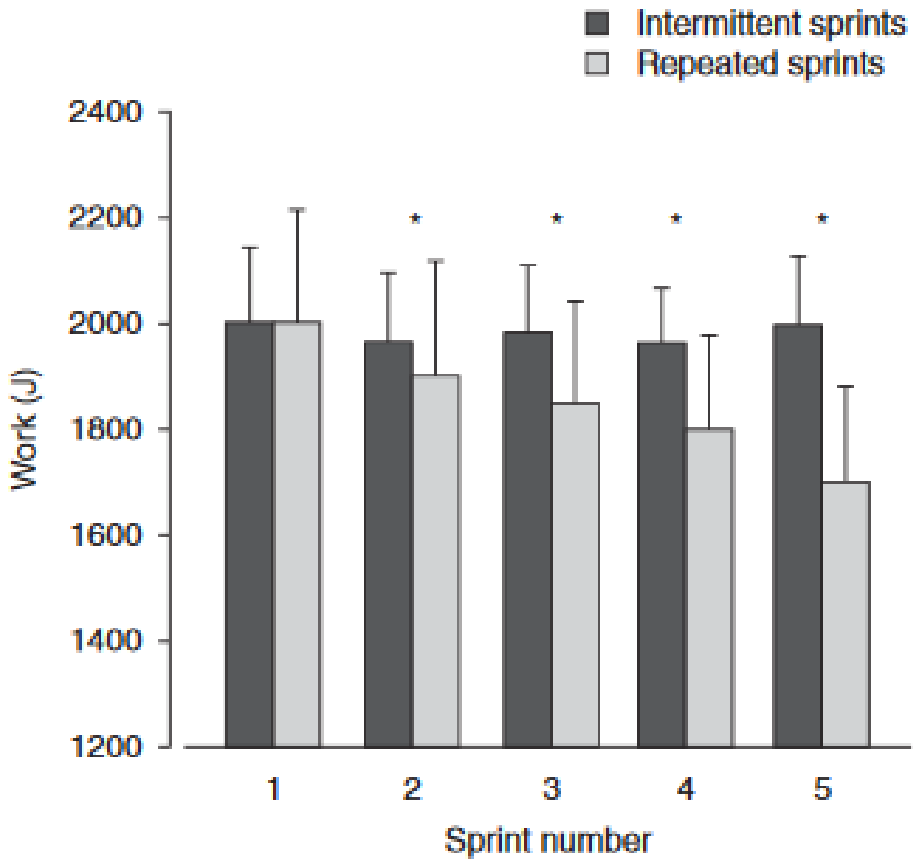
Fatigue and high intensity activity



Percent of live time spent in high-intensity activity by various positional groups in the different quarters of the matches.

2007 Abdelkrim, N. B., El Fazaa, S., & El Ati, J. Time–motion analysis and physiological data of elite under-19-year-old basketball players during competition. *British journal of sports medicine*.

Repeated Sprint Ability



Graph showing the effects of rest duration on maximal 4 sec, cycle sprint performance. Intermittent sprints were performed every 2 min, [19] whereas repeated sprints were executed every 30 sec. [20]
* Significantly different from sprint 1 in the repeated-sprint condition.

Girard, O., Mendez-Villanueva, A., & Bishop, D. (2011). Repeated-sprint ability—part I: factors contributing to fatigue. *Sports medicine*, *41*, 673-694.

Sprint acceleration and fatigue

Parameters	First sprints or Pre-RS values	Last sprints or Post-RS values	*p*-values	Percentage of changes	Effect size (upper-lower 95% CI)	
Muscle Activity (% of MVIC)						
First half of stance RF	70.4 (35.4)	55.7 (26.9)	0.001	−20.2 (16.0)	0.41 (0.20–0.63)	Small
Entire swing BF	64.3 (20.7)	58.8 (21.1)	0.034	−8.1 (13.5)	0.26 (0.02–0.50)	Small
Entire swing glut	**64.7 (18.5)**	**49.8 (8.7)**	**0.006**	**−19.9 (16.4)**	**0.81 (0.28–1.33)**	**Moderate**
Entire swing VL	**78.9 (34.3)**	**47.2 (15.6)**	**0.006**	**−33.6 (21.9)**	**0.92 (0.31–1.52)**	**Moderate**
Entire swing RF	69.5 (21.7)	60.1 (19.0)	0.004	−12.4 (13.5)	0.44 (0.17–0.70)	Small
End of swing BF	95.0 (35.8)	89.1 (35.5)	0.085	−5.6 (11.8)	0.16 (−0.03 – 0.36)	Negligible
End of swing glut	**99.2 (32.9)**	**79.6 (13.0)**	**0.024**	**−15.5 (16.3)**	**0.60 (0.09–1.10)**	**Moderate**
End of swing VL	**124.1 (56.1)**	**74.6 (23.8)**	**0.01**	**−32.3 (23.8)**	**0.88 (0.25–1.51)**	**Moderate**
End of swing RF	76.7 (29.1)	64.1 (21.7)	0.007	−14.0 (15.2)	0.43 (0.14–0.73)	Small

Values are presented with mean (standard deviation). Significant differences ($p < 0.05$) with moderate or more effects were highlight in bold.P_{max}, maximal power output; F_H, horizontal ground force; F_V, vertical ground force; F_{Tot}, total ground force; V_{max}, maximal velocity; KFlex, knee flexors; KExt, knee extensors; HFlex, hip flexors; HExt, hip extensors; ecc, eccentric mode of contraction; con, concentric mode of contraction; BF, biceps femoris; Glu, gluteus maximus; VL, vastus lateralis; RF, rectus femoris; MVIC, maximal voluntary isometric contraction.

« The horizontal force production seems to be more dependent on the function of the hip extensors and gluteus maximus. »

2018 Edouard, P., Mendiguchia, J., [...] & Morin, J. B. Sprint acceleration mechanics in fatigue conditions: compensatory role of gluteal muscles in horizontal […] protection of hamstring muscles. *Frontiers in physiology*.

Gluteus maximus with Hip thrust

Table 1 Mean (± SD) and peak EMG amplitudes (% MVIC) of the upper gluteus maximus, lower gluteus maximus, biceps femoris, and vastus lateralis during the barbell hip thrust and back squat

	Upper Gluteus Maximus	Lower Gluteus Maximus	Biceps Femoris	Vastus Lateralis
Mean				
Back squat	29.35 ± 16.45	45.29 ± 23.54	14.92 ± 6.64	110.35 ± 47.24
Barbell hip thrust	69.46 ± 32.64*	86.75 ± 26.99*	40.78 ± 22.13*	99.47 ± 92.28
Peak				
Back squat	84.85 ± 42.91	129.60 ± 60.45	37.50 ± 18.39	243.92 ± 121.63
Barbell hip thrust	171.75 ± 90.99*	215.85 ± 83.76*	86.87 ± 38.81*	215.83 ± 193.89
Isometric mean				
Back squat	10.11 ± 7.96	20.85 ± 19.95	7.38 ± 4.28	133.72 ± 107.59
Barbell hip thrust	87.08 ± 79.43*	115.72 ± 47.40*	42.5 ± 29.61*	110.66 ± 78.27
Isometric peak				
Back squat	17.87 ± 16.96	34.30 ± 32.77	13.73 ± 9.99	201.28 ± 162.69
Barbell hip thrust	128.22 ± 112.92*	180.45 ± 78.16*	67.67 ± 45.77*	175.82 ± 124.34

2015 Contreras, B., […] & Cronin, J. A comparison of gluteus maximus, biceps femoris, and vastus lateralis electromyographic activity in the back squat and barbell hip thrust exercises. *Journal of applied biomechanics*.

Type of hip thrust

TABLE 1. Differences in EMG activity of each muscle by exercise.*

Muscle	Variation	Mean (%)	*SD* (%)	95% confidence interval	Significant differences ($p < 0.05$)
GMax	OHT	55.22	20.83	35.96–74.48	RHT
	PHT	65.87	23.28	44.34–87.40	–
	RHT	86.18	34.30	54.46–117.90	OHT
	FHT	51.38	17.93	34.79–67.96	–

*EMG = electromyographic activity; OHT = original hip thrust; PHT = pull hip thrust; RHT = rotation hip thrust; FHT = feet-away hip thrust; RF = rectus femoris; VM = vastus medialis; VL = vastus lateralis; GMax = gluteus maximus; GMed = gluteus medius; BF = biceps femoris; ST = semitendinosus.

⇨ Rotational Hip Thrust

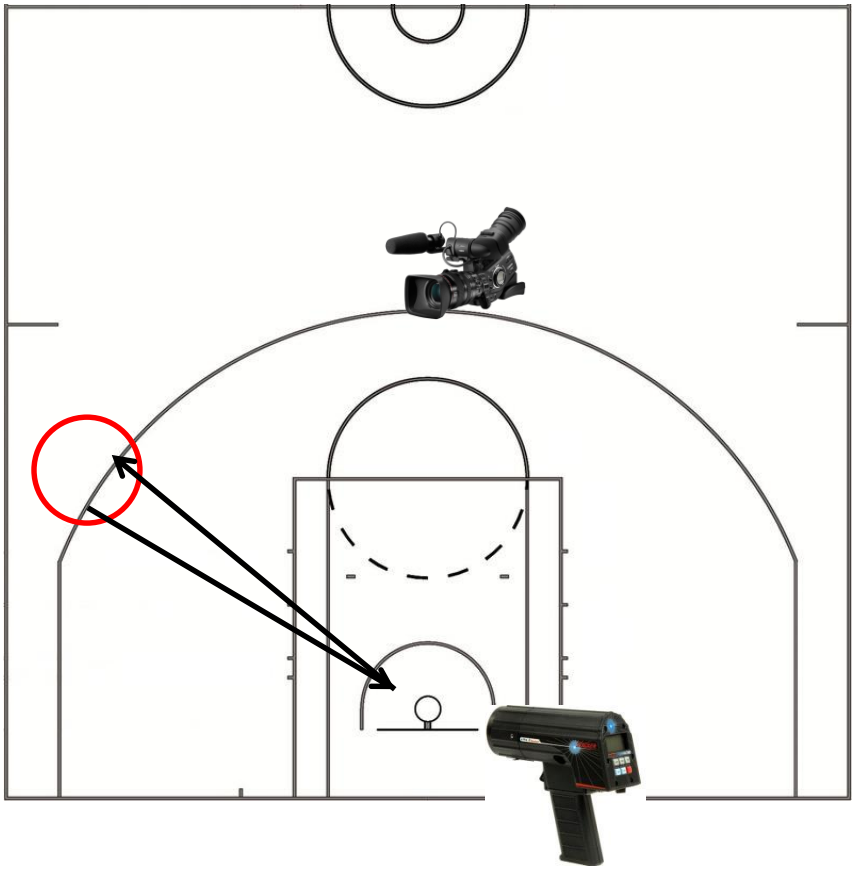
2020 García, C. L. C., Rueda, J., Luginick, B. S., & Navarro, E. Differences in the electromyographic activity of lower-body muscles in hip thrust variations. *The Journal of Strength & Conditioning Research*.

Goal

- Does the hip extensor and gluteus maximus work helps to go faster under fatigue?

- The rotational hip trust work improves both the best time and decreases the loss of the decrement score.

Tests



4 min run at 50% MSS.

Buchheit *IJSPP* 2017

606 modified (Right and left).

Sayers *JSCR* 2014

6 sprints.

Fessi *Biol sport* 2016

30 seconds between each sprint.

Kyles *JSCR* 2023

Analysis

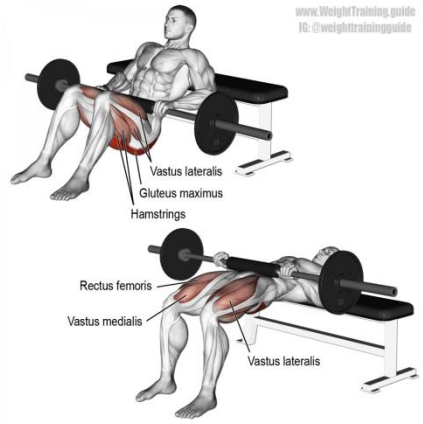
Acceleration.

Sprint best time.

$$S_{dec}(\%) = \left\{ \frac{(S_1 + S_2 + S_3 + \ldots + S_{final})}{S_{best} \times \text{number of sprints}} - 1 \right\} \times 100$$

Glaister *JSCR* 2008

Training



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

Sentadilla (22 Sesiones, 11 semanas)				
Carga (kg)	Velocidad Sesión 1 (cm/s)	Velocidad Sesión 22 (cm/s)	Mejora Inicial vs Final (cm/s)	Mejora Inicial vs Final (%)
20	142	155	13	9
40	120	133	13	11
60	100	112	12	12
80	80	96	16	20
100	66	82	16	24
110	60	70	10	17
120	50	62	12	24
130	-	51	-	-

Training program

- Warm up

- **TABLE 2.** Sets, repetition schemes, and loads used for the front squat and hip thrust.*

Week	Sets	Repetitions	Load
1	4	12	12RM
2	4	10	10RM
3	4	10	10RM
4	4	8	8RM
5	4	8	8RM
6	4	6	6RM

*RM = repetition maximum.

2017 Contreras, B., […] & Cronin, J. B. Effects of a six-week hip thrust vs. front squat resistance training program on performance in adolescent males: a randomized controlled trial. *Journal of strength and conditioning research*.

Training program

Table 1

Relationships between different loads (%1RM) in barbell hip thrust exercise and the mean propulsive velocity (MPV) and mean velocity (MV) predicted with the regression model created.*

Load (%1RM)	MPV ($m \cdot s^{-1}$)	MV ($m \cdot s^{-1}$)
10	1.32 (1.15–1.50)	1.19 (1.05–1.34)
15	1.26 (1.09–1.44)	1.14 (1.00–1.29)
20	1.20 (1.03–1.38)	1.09 (0.95–1.23)
25	1.14 (0.97–1.32)	1.04 (0.90–1.18)
30	1.08 (0.91–1.26)	0.99 (0.84–1.13)
35	1.02 (0.85–1.20)	0.94 (0.79–1.08)
40	0.96 (0.79–1.14)	0.89 (0.74–1.03)
45	0.90 (0.73–1.08)	0.84 (0.69–0.98)
50	0.84 (0.67–1.02)	0.79 (0.64–0.93)
55	0.78 (0.61–0.96)	0.74 (0.59–0.88)
60	0.72 (0.55–0.90)	0.68 (0.54–0.83)
65	0.66 (0.49–0.84)	0.63 (0.49–0.78)
70	0.60 (0.43–0.78)	0.58 (0.44–0.73)
75	0.54 (0.37–0.72)	0.53 (0.39–0.68)
80	0.48 (0.31–0.66)	0.48 (0.34–0.63)
85	0.42 (0.25–0.60)	0.43 (0.29–0.57)
90	0.36 (0.19–0.54)	0.38 (0.24–0.52)
95	0.30 (0.13–0.48)	0.33 (0.19–0.47)
100	0.24 (0.07–0.42)	0.28 (0.13–0.42)

*%1RM = percentage of 1 repetition maximum.

2021 de Hoyo, M., Núñez, F. J., Sañudo, B., Gonzalo-Skok, O., Muñoz-López, A., […] & Nimphius, S. Predicting loading intensity measuring velocity in barbell hip thrust exercise. *The Journal of Strength & Conditioning Research*.

Results

- To become

Discussion

- Ok, because….
- …
- No, perhaps

Conclusion
or Take home messages

- ✓ Point 1
- ✓ Point 2
- ✓ Point 3

Annex

- Marshall 2014
- …
- ….

Biomechanical Factors Associated With Time to Complete a Change of Direction Cutting Maneuver

Brendan M. Marshall,[1,2,3] Andrew D. Franklyn-Miller,[1,4] Enda A. King,[1] Kieran A. Moran,[2,3] Siobhán C. Strike,[5] and Éanna C. Falvey[1,4]

The Journal of Strength & Conditioning Research,
2014,
vol. 28,
no 10,
p. 2845-2851.

gastrocnemius muscles (ankle plantar flexors) are overloaded more, and ground contact times are shorter, in hurdle jumps than in drop jumps.

Pelvic control exercises should be prescribed in an effort to enhance frontal plane pelvic control during eccentric loading. Frontal plane control of the pelvis in single-limb stance is determined, at least in part, by the neuromuscular ability of the gluteal muscles, and in particular gluteus medius (23). Common exercises to train the gluteals include bridging and resisted side steps (29), as well as more sport-specific exercises such as single-leg squats and single-leg landings (21).

To encourage athletes to rotate their trunk in the desired direction of travel while cutting, augmented technique feedback (e.g., video playback combined with coaching advice) may be particularly useful. Myer et al. (22) found that augmented feedback on deficits identified in a drop jump assessment resulted in a significant improvement in jumping technique.

Results

Table 1 Mean (±SD) descriptive data and graded maximal test results of the subjects (N = 13)

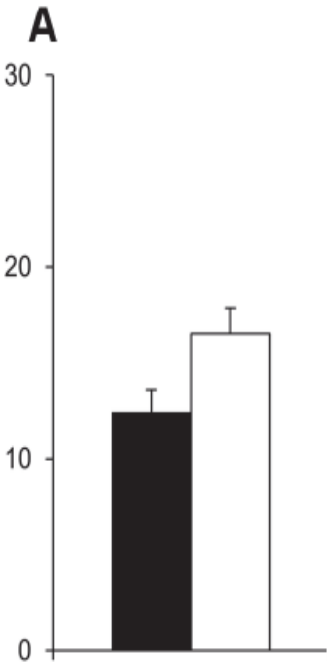
Age (years)	35 ± 5
Height (cm)	179 ± 6
Body mass (kg)	76.6 ± 5.6
BMI (kg m^{-2})	23.9 ± 1.6
VO_{2max} (l min^{-1})	4.1 ± 0.4
VO_{2max} (ml kg^{-1} min^{-1})	54.1 ± 3.6
AerT (% of VO_{2max})	57.9 ± 6.2
AnT (% of VO_{2max})	80.6 ± 4.7
HR_{max} (bpm)	183 ± 9
vVO_{2max} (km h^{-1})	15.9 ± 0.8
BLa_{max} (mmol l^{-1})	11.8 ± 2.5

BMI body mass index, VO_{2max} maximal oxygen uptake, *AerT* aerobic threshold according to Aunola and Rusko (1984), *AnT* anaerobic threshold according to Aunola and Rusko (1984), vVO_{2max} maximal speed at the graded maximal treadmill test, HR_{max} maximal heart rate, BLa_{max} maximal blood lactate level at the graded maximal treadmill test

Results

Figure 3. Description of hip angle as measured from the horizontal.

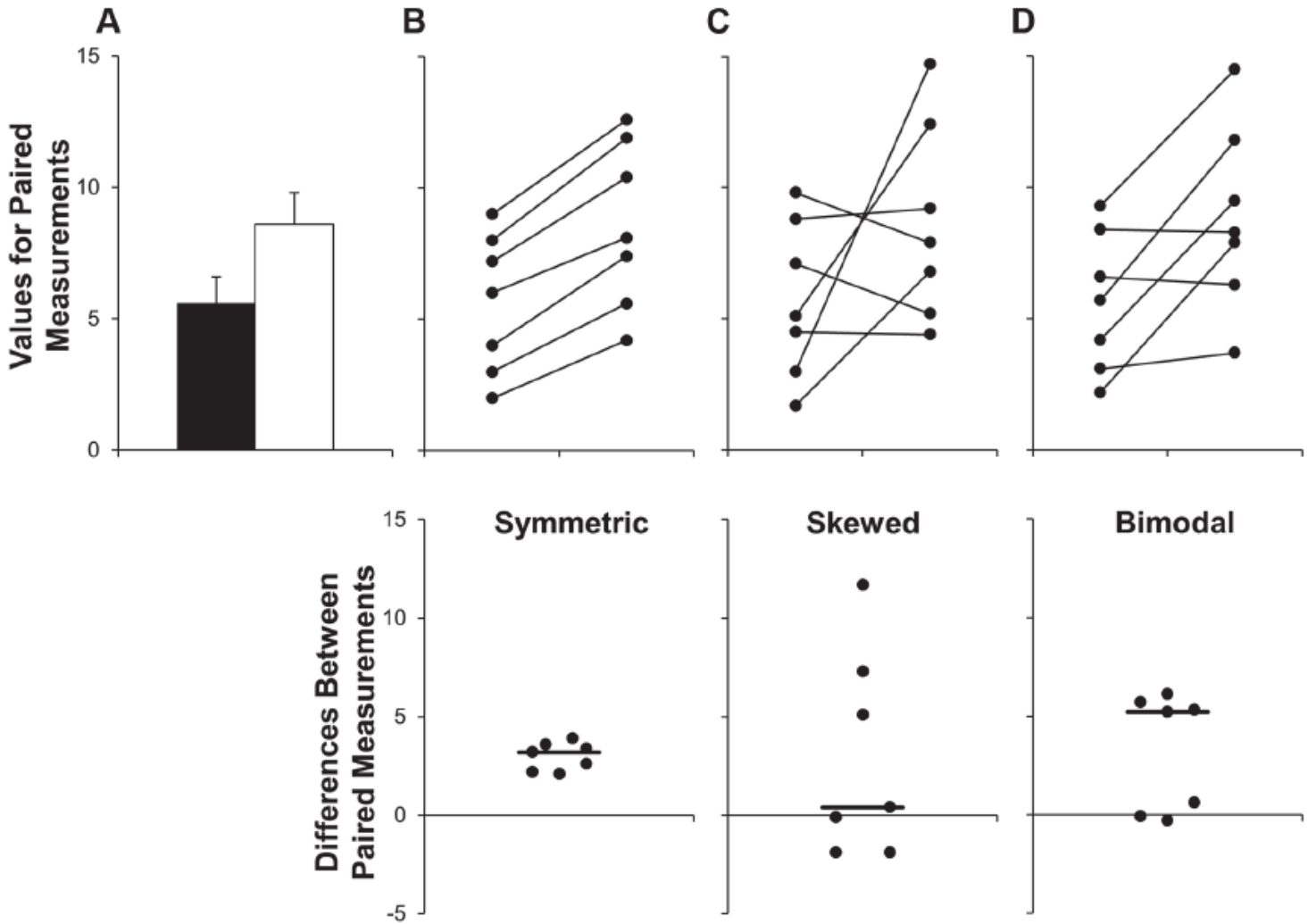
Results



NO

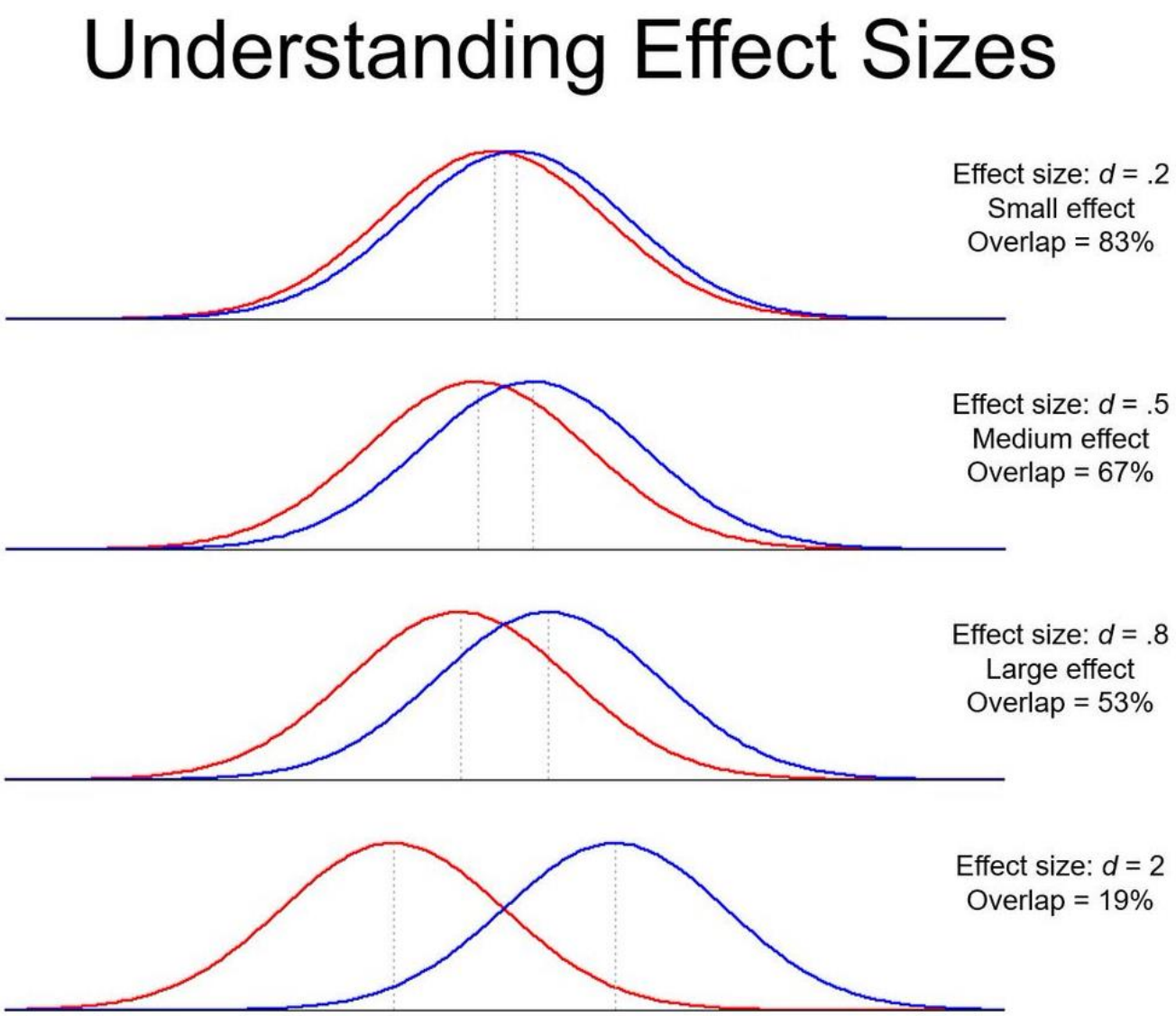
2015 Weissgerber, T. L., Milic, N. M., Winham, S. J., & Garovic, V. D. Beyond bar and line graphs: time for a new data presentation paradigm. *PLoS biology*.

Results



2015 Weissgerber, T. L., Milic, N. M., Winham, S. J., & Garovic, V. D. Beyond bar and line graphs: time for a new data presentation paradigm. *PLoS biology*.

Results


Understanding Effect Sizes
Effect size: d = .2
Small effect
Overlap = 83%
Effect size: d = .5
Medium effect
Overlap = 67%
Effect size: d = .8
Large effect
Overlap = 53%
Effect size: d = 2
Overlap = 19%

Procédure « scientifique »

1/ Faire un tableau de vos données en indiquant pour chaque colonne la variable prise en compte.

Exemple :

	Hauteur CMJ Pre	Hauteur CMJ Post
1	20.03	28.15
2	21.29	28.15
3	42.93	44.31
4	20.03	24.37
5	30.15	34.9

Procédure « scientifique »

2/ Utiliser JASP pour savoir si l'hypothèse est vérifiée (H1).

Exemple :

$BF_{10} = 6.298$

$BF_{01} = 0.159$

median = -1.545

95% CI: [-3.433, -0.540]

Ici H1 est supérieure à H0.

https://www.youtube.com/watch?v=rUWlwOfLyZc

Procédure de traitement

1/ Faire un tableau de vos données en indiquant pour chaque colonne la variable prise en compte et calculer la moyenne, la médiane et l'écart-type.

Exemple :

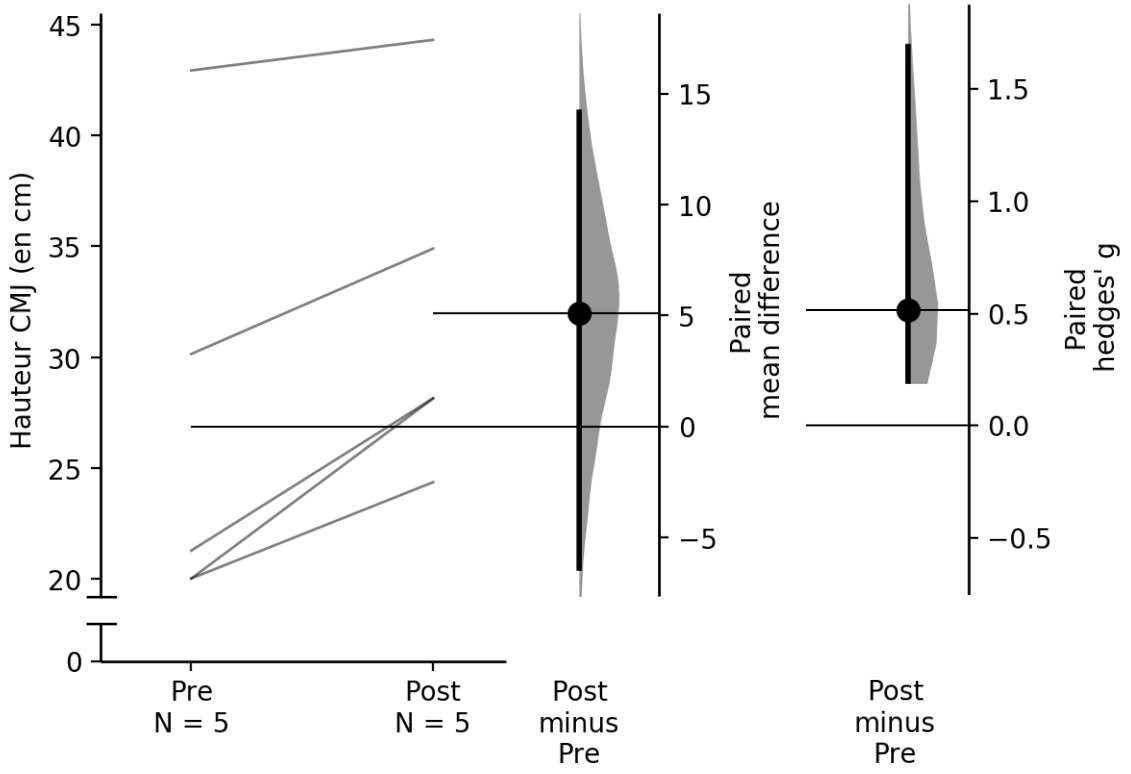
	Hauteur CMJ Pre	Hauteur CMJ Post
1	20.03	28.15
2	21.29	28.15
3	42.93	44.31
4	20.03	24.37
5	30.15	34.9

	Hauteur CMJ Pre	Hauteur CMJ Post
Moyenne	26,886	31,976
Médiane	21,290	28,150
Ecart type	9,917	7,871

Procédure de traitement

2/ Pour visualiser celles-ci, éditer le graphique à partir de http://www.estimationstats.com/#/.

Exemple :

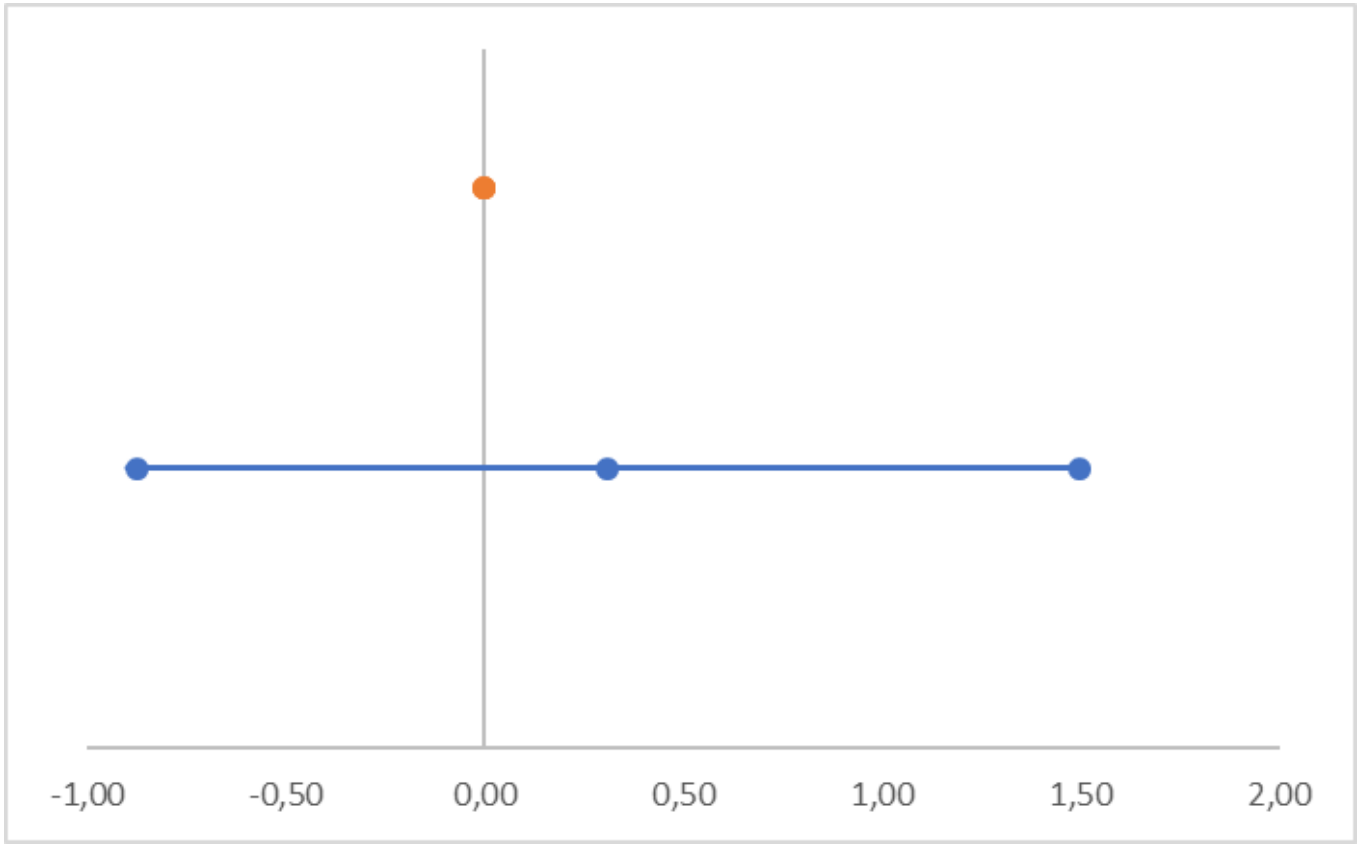


Procédure de traitement

3/ Pour connaître l'intérêt de votre protocole d'entraînement, comme votre échantillon est de petite taille (n<20), il conviendra d'utiliser le *g* de Hedges, plutôt que le *d* de Cohen pour la taille d'effet.
https://www.statology.org/hedges-g-calculator/

Et l'intégrer dans la feuille excel d'Anthony N Turner :
Cf moodle (Feuille Anthony N Turner).

Procédure de traitement



Effet protocole (-0,87; 0,31; 1,50)

Tests et Training

Vous filmerez votre protocole et utiliserez dartfish pour insérer les éléments pertinents.

Vous montrerez quelques mouvements réalisés lors de vos entraînements.

Tests

- 8x30 meters with 2’ rest.

Analysis of time splits

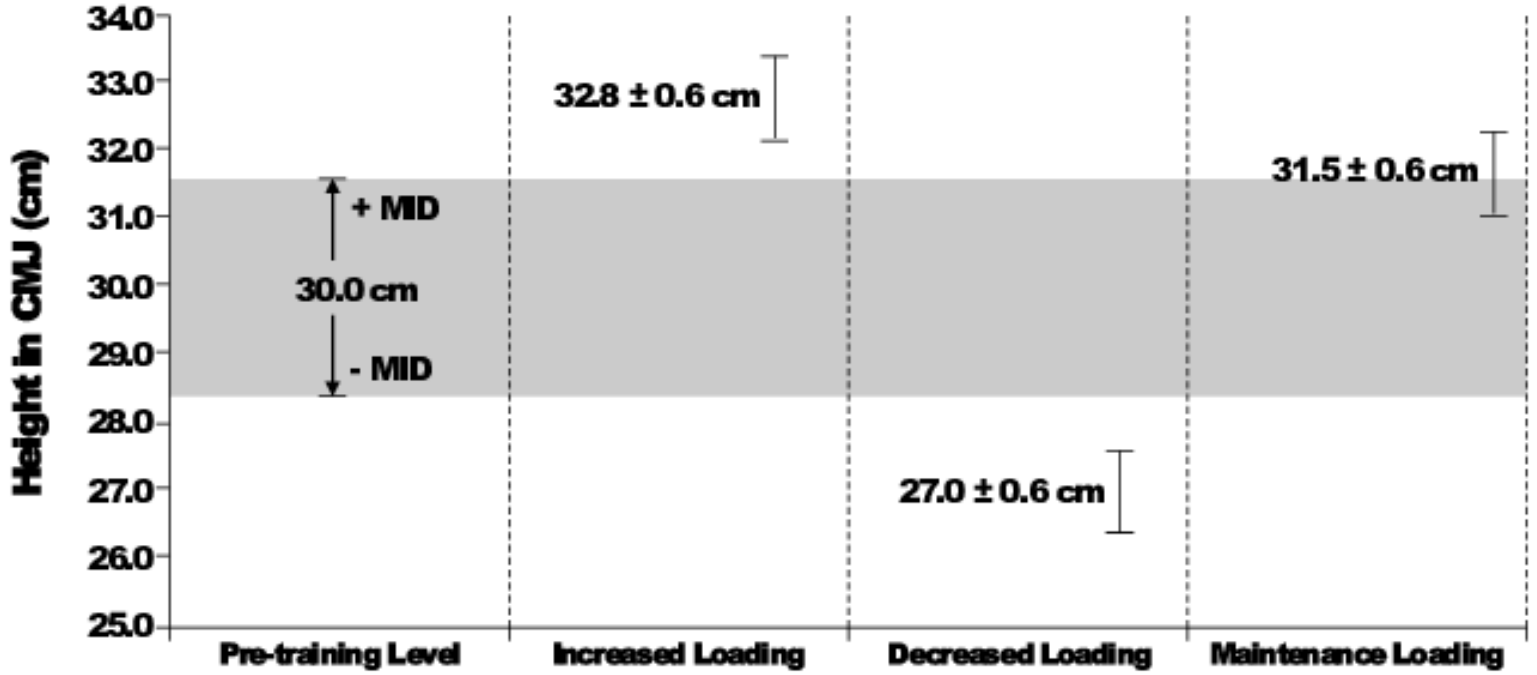
- TEM = $SD_{diff}/ \sqrt{2}$
- MID = TEM x *1,761*

Claudino *JAE* 2016

2016 Claudino, J. G., Cronin, J. B., Amadio, A. C., & Serrão, J. C. How can the Training Load be Adjusted Individually in Athletes with an Applied Statistical Approach?. J Athl Enhanc.

Procédure de traitement

Lorsque le test est reproduit plusieurs fois, faire une analyse individuelle.



Claudino *JAE* 2016

Procédure de traitement

Table 1: Data from reliability sessions for CMJ performance

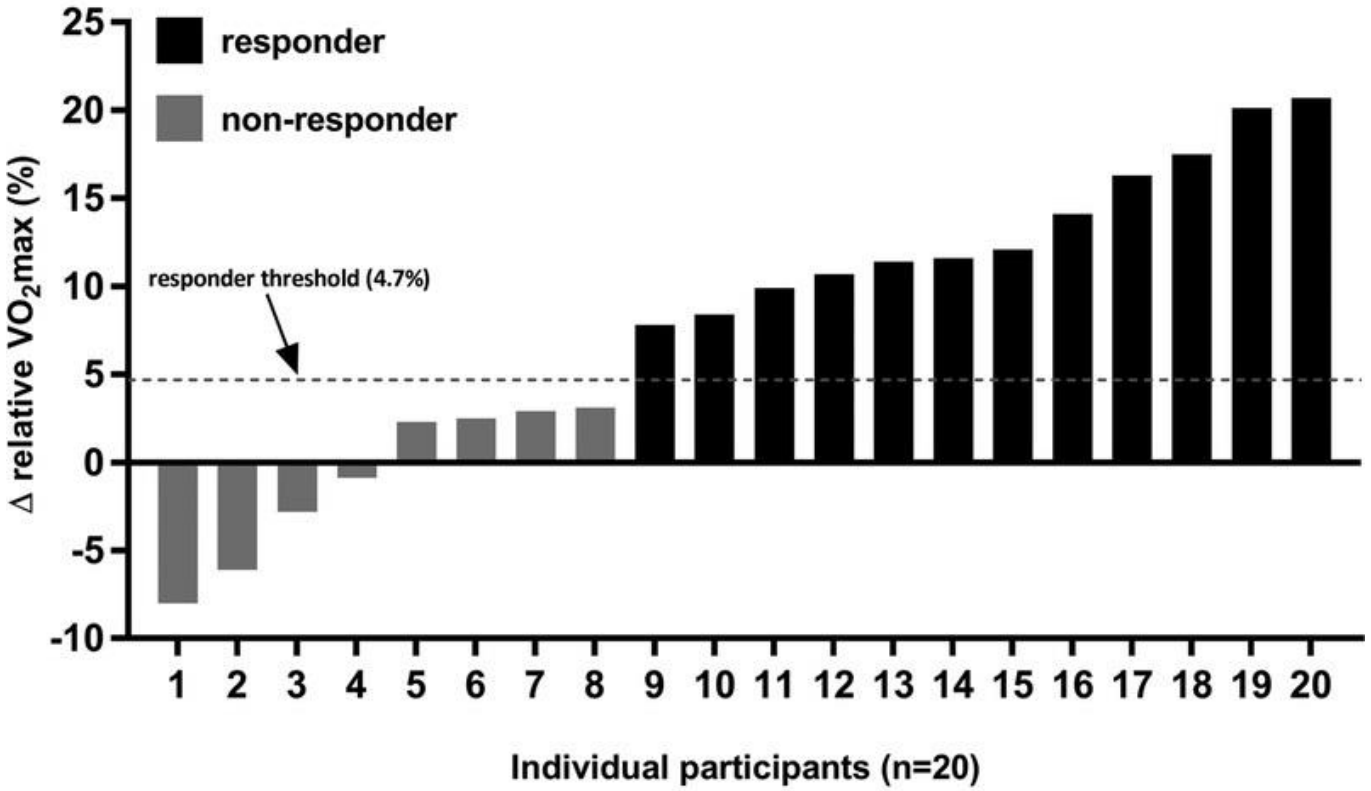
Athlete X	Day 1	Day 2	Difference Scores
Rep1	28.2	30.9	-2.7
Rep2	27.5	29.4	-1.9
Rep3	27.5	29.8	-2.3
Rep4	30.0	30.3	-0.3
Rep5	29.1	29.2	-0.1
Rep6	29.3	30.9	-1.6
Rep7	28.5	29.4	-0.9
Rep8	28.2	28.7	-0.5
		SD_{diff}	1.0

$$TEM = SD_{diff} / \sqrt{2}$$

$$MID = TEM \times 1{,}761$$

Claudino *JAE* 2016

Procédure de traitement



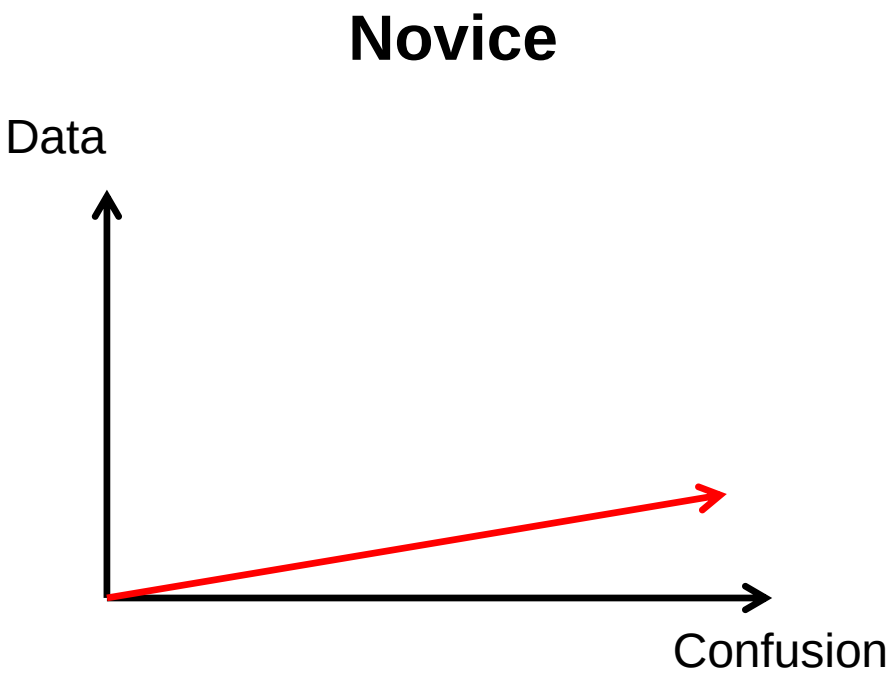
Weatherwax
MSSE 2019

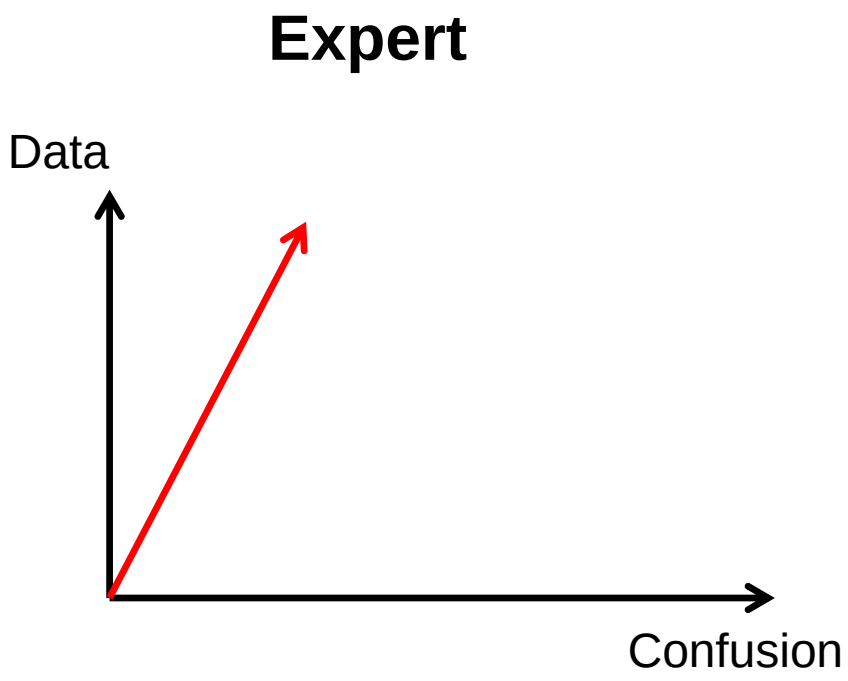
$TE = SD_{diff} / \sqrt{2}$

Répondeurs quand TE x 2

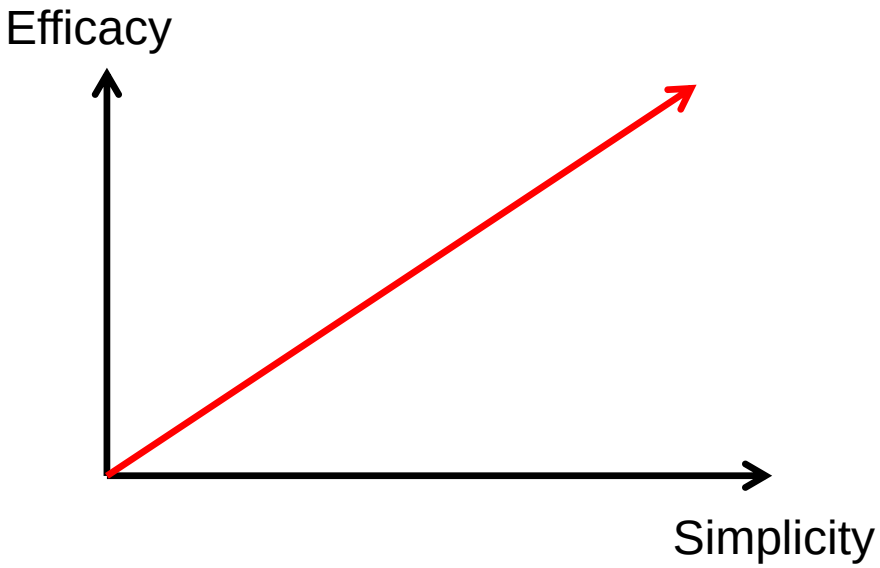
Bonafiglia *PO* 2016

Know what to evaluate, how to analyze it, and especially which interpretations you can made.





Don’t forget



“Aimons les nouveautés en novateurs prudents.”

Casimir Delavigne

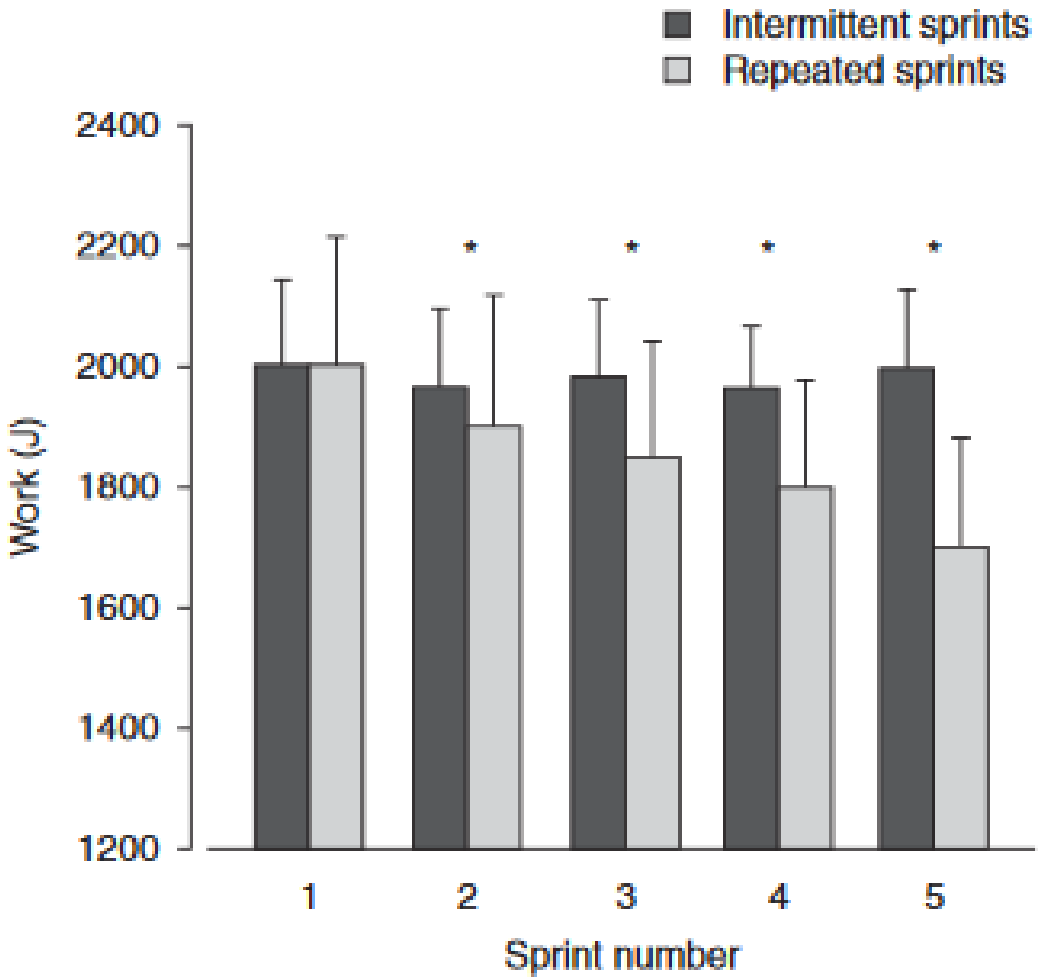
Results

Table 2. Summary table of the eight selected GPS metrics to monitor the players match-play performance before (6 match mean [SD]) and after (5 match mean [SD]) two weeks of RST according to the first- and second-half's of match-play, accompanied by absolute and relative (%) change in GPS metrics, smallest worthwhile change (SWC), typical error (TE) and practical significance of a true positive change (>SWC) occurring.

GPS and MEMs device metrics	Mean (SD) Pre RST	Mean (SD) Post RST	SWC	TE	Absolute Change (%)	*Qualitative*
First Half						
Total distance covered (m)	4406.5 (297.6)	4270.2 (426.6)	59.5	121.5	-136.3 (-3.1)	*Possible* ↓
Total high speed distance (m)	448.5 (56.4)	507.6 (144.0)	11.3	23.0	59.1 (13.2)	*Likely* ↑
Total relative distance ($.min^{-1}$)	91.7 (10.9)	95.0 (9.9)	2.2	4.4	3.3 (3.6)	*Possible* ↑
Total relative high intensity running (%)	10.2 (1.3)	11.8 (2.9)	0.3	0.5	1.6 (3.1)	*Likely* ↑
Maximum velocity ($km{\cdot}h^{-1}$)	28.4 (3.2)	25.9 (3.2)	0.6	1.3	-2.5 (-9.4)	*Likely* ↓
No of RHIE (n)	9.8 (5.7)	8.4 (1.5)	1.1	2.3	-1.4 (-13.8)	*Possible* ↓
PlayerLoadTM (AU)	429.7 (11.7)	412.7 (39.1)	2.3	4.8	-17.0 (-3.9)	*Very Likely* ↑
Relative PlayerLoadTM ($AU.min^{-1}$)	8.8 (0.4)	9.2 (0.8)	0.1	0.2	0.4 (4.4)	*Likely* ↑
Second Half						
Total distance covered (m)	4386.8 (449.1)	4551.2(216.1)	89.8	182.3	164.5 (3.7)	*Possible* ↑
Total high speed distance (m)	488.5 (141.5)	559.6 (103.3)	28.3	57.8	71.1 (14.6)	*Possible* ↑
Total relative distance ($.min^{-1}$)	89.7 (7.1)	89.0 (6.5)	1.4	2.9	-0.7 (-0.8)	*Possible* ↓
Total relative high intensity running (%)	11.2 (3.1)	12.3 (2.6)	0.6	1.3	1.2 (10.7)	*Possible* ↑
Maximum velocity ($km{\cdot}h^{-1}$)	28.4 (3.2)	30.6 (2.5)	0.6	1.3	2.1 (7.6)	*Likely* ↑
No of RHIE (n)	11.0 (3.4)	9.2 (3.1)	0.7	1.4	-1.8 (16.4)	*Possible* ↓
PlayerLoadTM (AU)	413.8 (37.8)	437.4 (27.4)	7.6	15.4	23.6 (5.7)	*Possible* ↑
Relative PlayerLoadTM ($AU.min^{-1}$)	8.4 (0.8)	8.6 (1.0)	0.2	0.3	0.1 (1.5)	*Possible* ↑

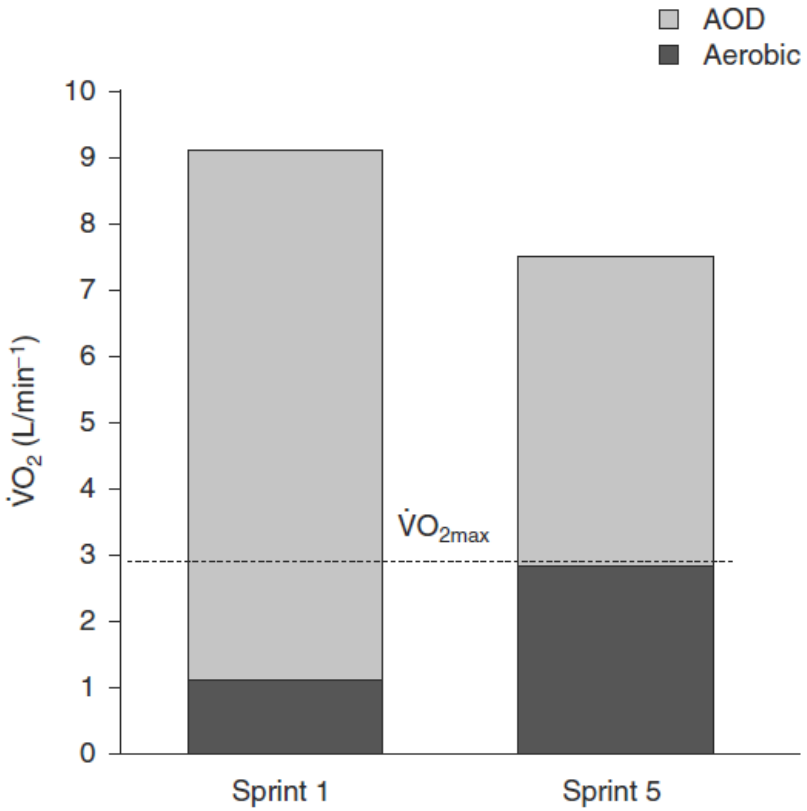
RHIE = Repeated high intensity exercise; AU = Arbitrary units; SWC = smallest worthwhile change; TE = Typical error.

Fatigue



Girard *SM* 2011

Aerobic vs anaerobic



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