Science & Cycling
28-29 June, Düsseldorf, Germany

Power distribution, performance changes & bioelectrical impedance tissue properties during preparation period of professional cyclists

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Dusseldorf, 29th June 2017

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Body composition studies on athletes are exponentially increasing in these last years thanks to optimization of algorithm and protocols in the sport field.

Scand J Med Sci Sports 2015: ■■: ■■–■■
doi: 10.1111/sms.12513

SCANDINAVIAN JOURNAL OF MEDICINE & SCIENCE IN SPORTS

Nutritional intake and anthropometric changes of professional road cyclists during a 4-day competition

C. Sánchez-Muñoz[1], M. Zabala[1], J. J. Muros[2]

Eur J Appl Physiol
DOI 10.1007/s00421-017-3552-x

ORIGINAL ARTICLE

The effect of hydration status on the measurement of lean tissue mass by dual-energy X-ray absorptiometry

Clodagh M. Toomey[1,2] · William G. McCormack[2] · Phil Jakeman[2]

Sports Med
DOI 10.1007/s40279-017-0694-2

REVIEW ARTICLE

Periodized Nutrition for Athletes

Asker E Jeukendrup[1]

European Journal of Sport Science, 2015
http://dx.doi.org/10.1080/17461391.2015.1084538

ORIGINAL ARTICLE

Body composition in female road and track endurance cyclists: Normative values and typical changes in female road and track endurance cyclists

ERIC C. HAAKONSSEN[1,2,3], MARTIN BARRAS[2], LOUISE M. BURKE[4,5], DAVID G. JENKINS[3], & DAVID T. MARTIN[1]

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Bioimpedance: the ideal field test

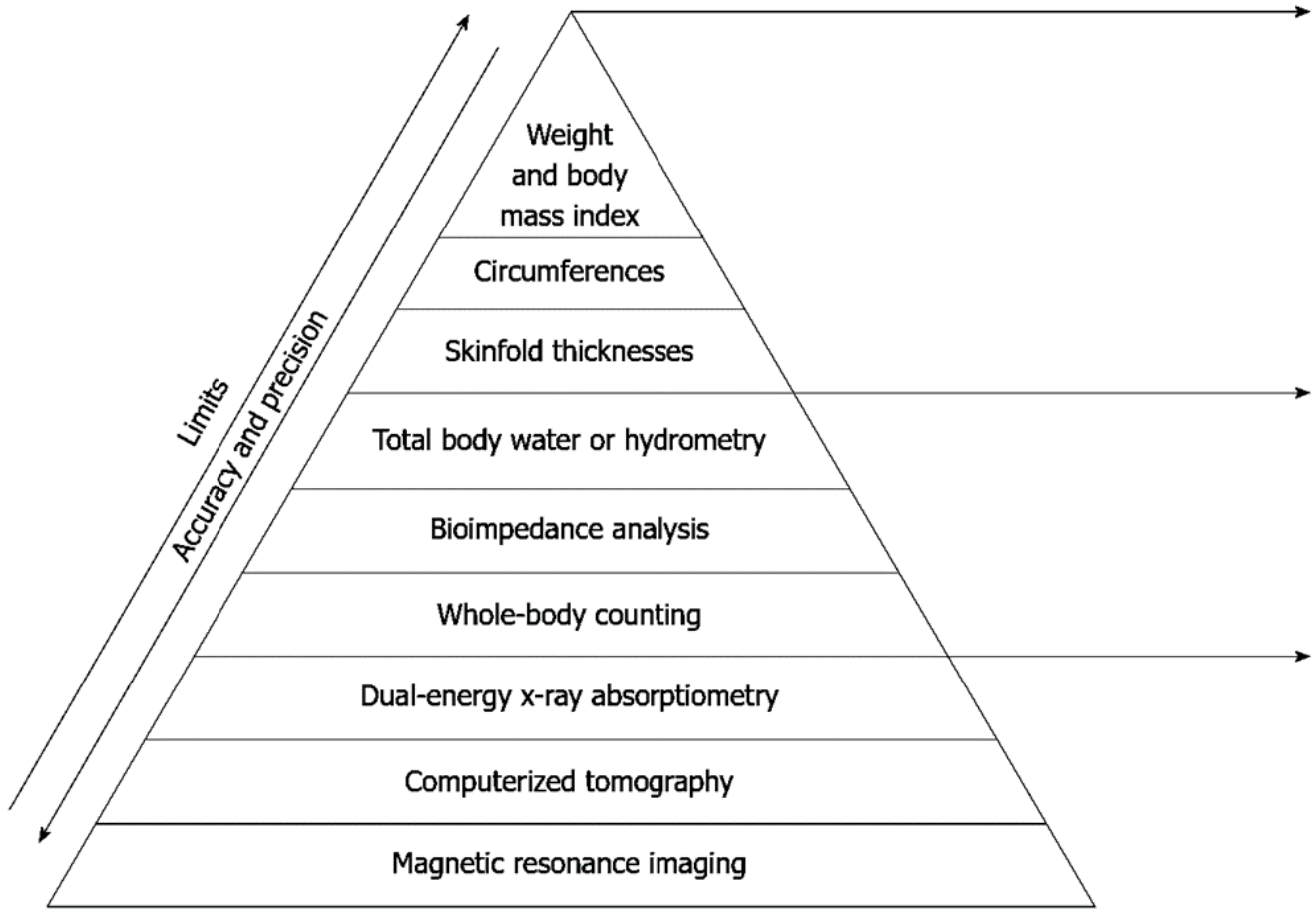
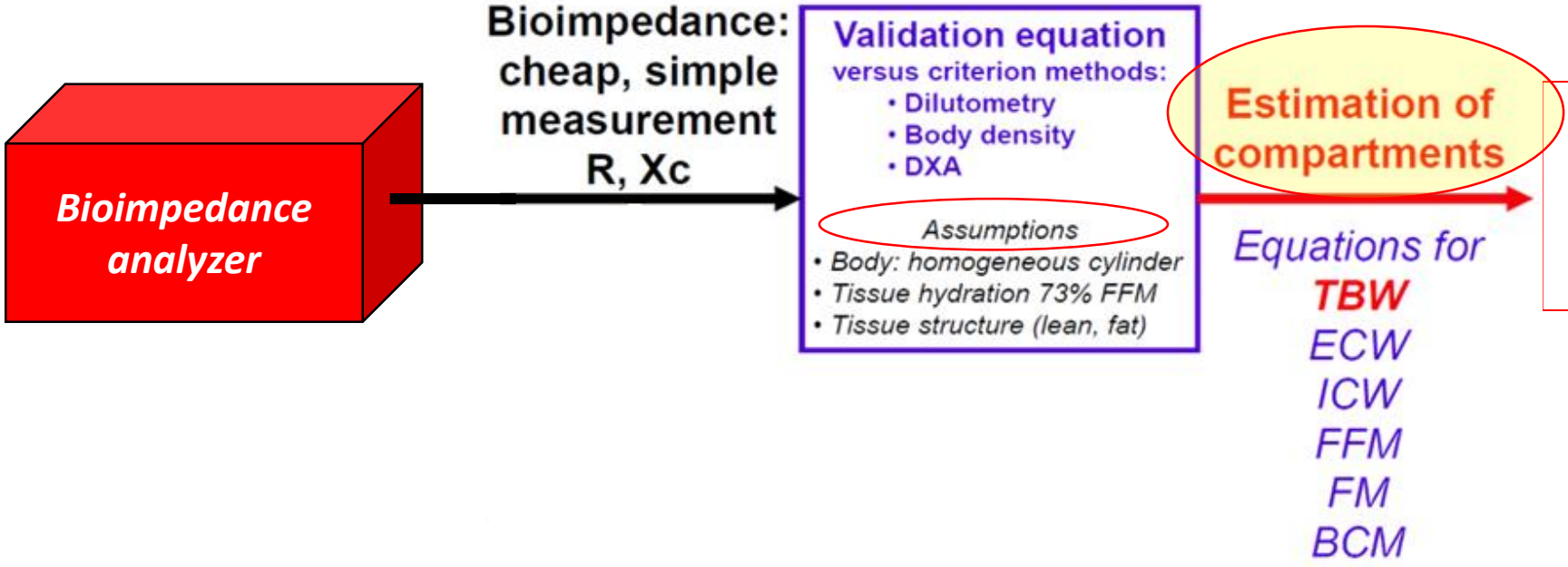


Figure 1 Techniques in body composition.

The right use of bioimpedance in sport settings



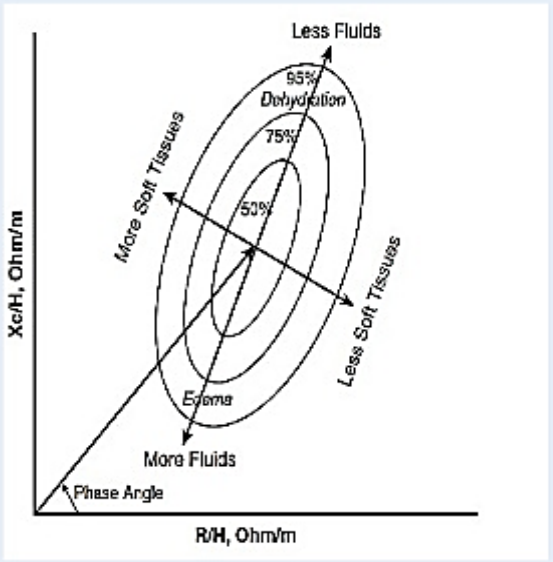
SEE of these equations is too big for the individual BC follow up, when the variation is below 5% on weight**

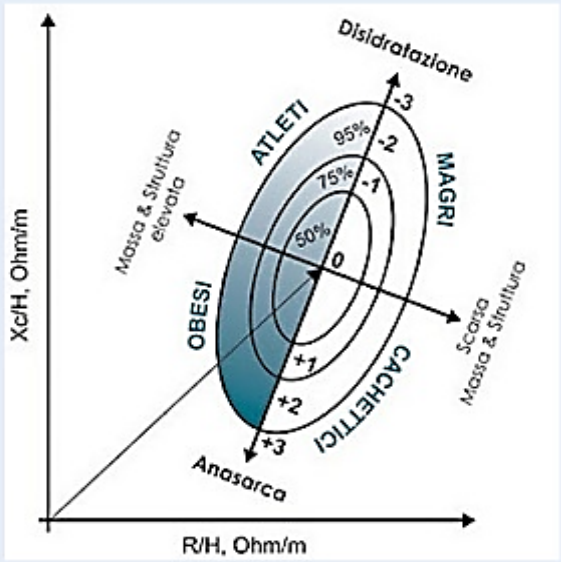
*Journal of Parenteral and Enteral Nutrition
Volume 39 Number 7 September 2015 787 –822

Bioimpedance:
cheap, simple
measurement
R, Xc

Vector analysis

Patterns of body composition
without equations/assumptions
Distance from the mean Z





Piccoli A et al. Kindey Int 1994;46.2:534-539

BENEFITS OF BIVA:

1. 5 times more sensitive to BC changes than conventional BIA
2. Able to detect fast and acute changes of BC* without body composition limitations
3. Validated to track fluid when WL≤2%**

*Lukaski, H. C. European journal of clinical nutrition 67 (2013): S2-S9.

** Gatterer, H. et al. *PloS one* 9.10 (2014): e109729.

BIA/BIVA in Cycling science: an increasing interest

2014: Body composition changes in professional cyclists during the 2011 Giro d'Italia, a 3-week stage race; *Marra, Maurizio, et al; Nutritional Therapy & Metabolism 32.1 (2014).*

2015: Body Water Status and Short-term Maximal Power Output during a Multistage Road Bicycle Race (Giro d'Italia 2014); *Pollastri et al 2015, Int J Sports Med*

2015: A novel method to assess changes in body fluids: 2015 Giro d'Italia bioimpedance vector analysis experience; *Giorgi A., et al 2015* (Poster)Endurance Research conference 2015 University of Kent

2016: Body fluid status and physical demand during the Giro d'Italia; *Pollastri et al 2016, Res Sports Med*

2016: **Qualitative body composition of cyclists: bioimpedance vector analysis discriminates different categories of cyclists;** *Giorgi A., et al Journal of Science and Cycling 5.2 (2016)*

2016: Segmental bioimpedance analysis in professional cyclists during a three week stage race; *Marra, Maurizio, et al. Physiological measurement 37.7 (2016): 1035*

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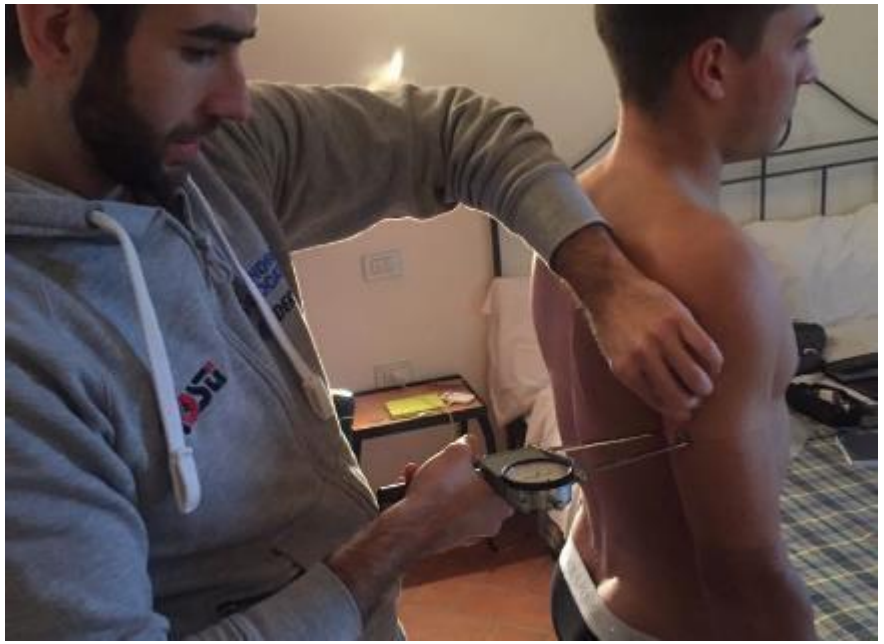
2017 : Cycling athletes bioimpedance vector norms …… under review manuscript Giorgi et at.



Power distribution, performance changes and bioelectrical impedance properties during the preparation period of professional cyclists

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SIDERMEC
LAVORAZIONE E COMMERCIO BANDA STAGNATA - WORKING AND SALE TINPLATE

Material & Methods

8 professional road cyclists

4 periods monitored:
November, December, January, February

Body composition and anthropometric data:
body mass, Bioimpedance Vector analysis (BIVA- Akern) and skinfold thickness measurements (7 sites, Australian institute of Sport)

External Training load and Performance indexes:

- Training volume and intensity (4 zones: <100, 100-300, 300-500, >500, Metcalfe et al, 2017)
- Training Stress Score (TSS)
- functional threshold power (FTP)
- peak power during 5 s (P5s)
- 5 min (P5min),
- 20 min (P20min)
- 60 min (P60min)

About the first period, detailed data acquisition has been done only for the last 10 days of the first month

Pre-season assessment

T_0 — November

Morning assessment in fasting condition

BIVA SF

T_{10} — December

Morning assessment in fasting condition

BIVA SF

External workload

WKO

T_{40} — January

Morning assessment in fasting condition

BIVA SF

External workload

WKO

T_{68}

Morning assessment in fasting condition

BIVA SF

External workload

WKO

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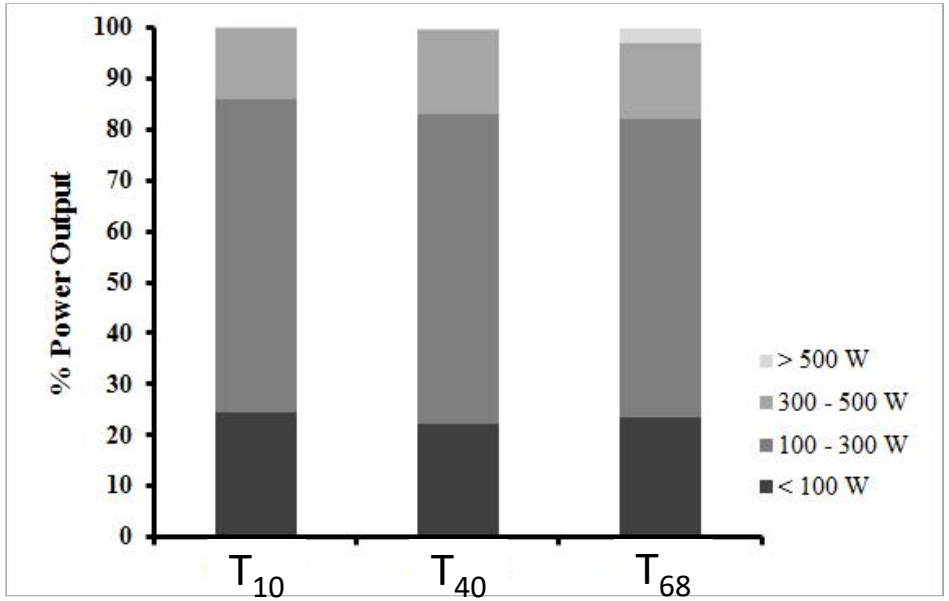
External workload

	T_{10}	T_{40}	T_{68}
Distance (km)	640±120#	2,720±270	2,060±200*
Climbing (m)	6,630±2,210#	30,400±9,324	16,560±6,690*
Cycling time (min)	1,256±280#	6,142±1100	3,890±90*
External work (Kj)	12,310±5,640#	63,035±10,385	42,628±4,338*
TSS	1,290±395#	5757±1500	3370±777*

*significantly different from T40,
#significantly different from T40 and T68

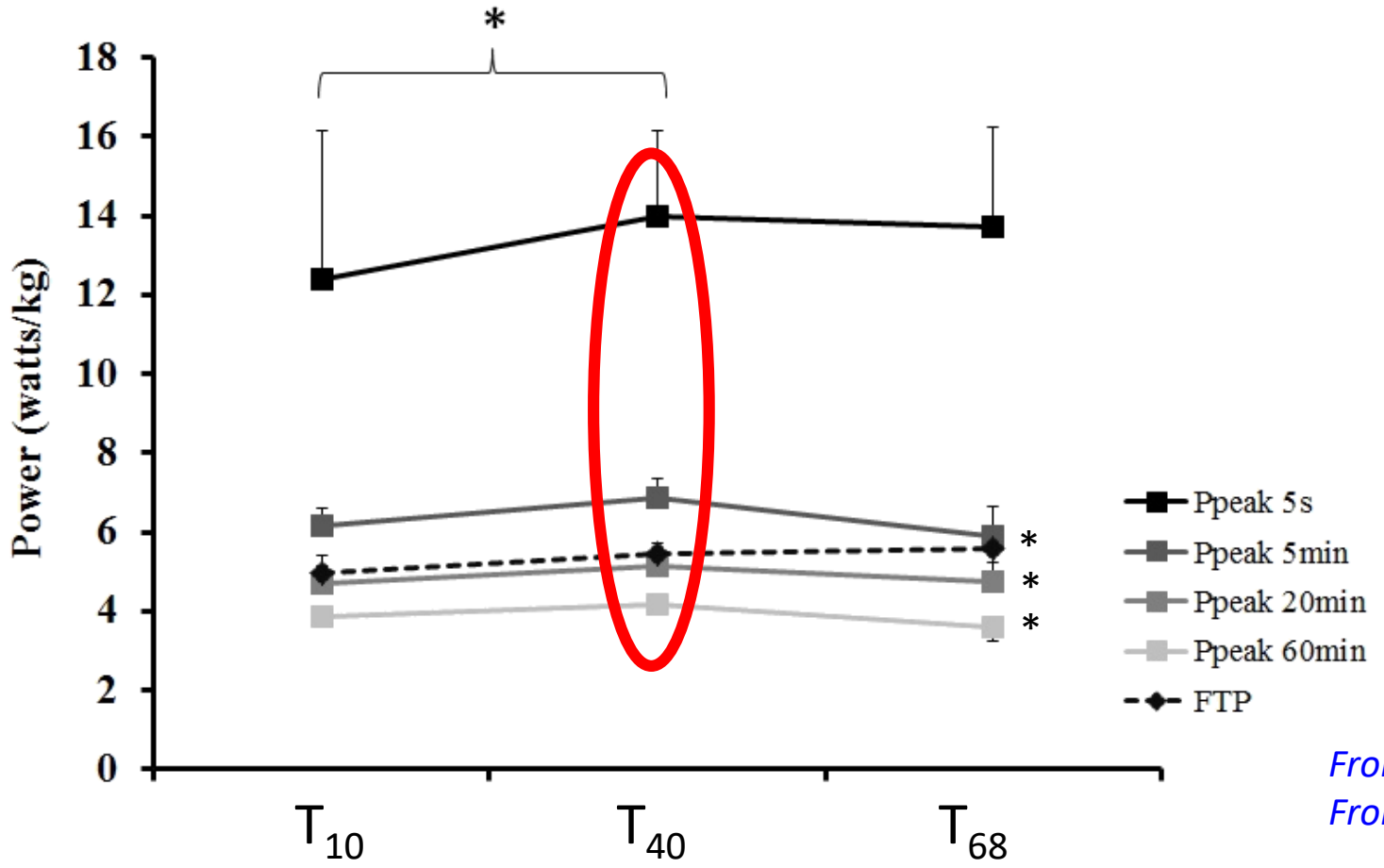
The distribution of power intensities



Zones	T10		T40		T68	
	% training volume	min	% training volume	min	% training volume
< 100 watts	25±6	1184±212	22±5*	932±157*	23±4
100 – 300 watts	61±7	3547±221	61±8	2351±175*	59±6
300 – 500 watts	14±7	918±432	17±6	594±124*	15±3#
> 500 watts	0.2±01	24±14	0.4±0.2*	128±233	2.9±5.3

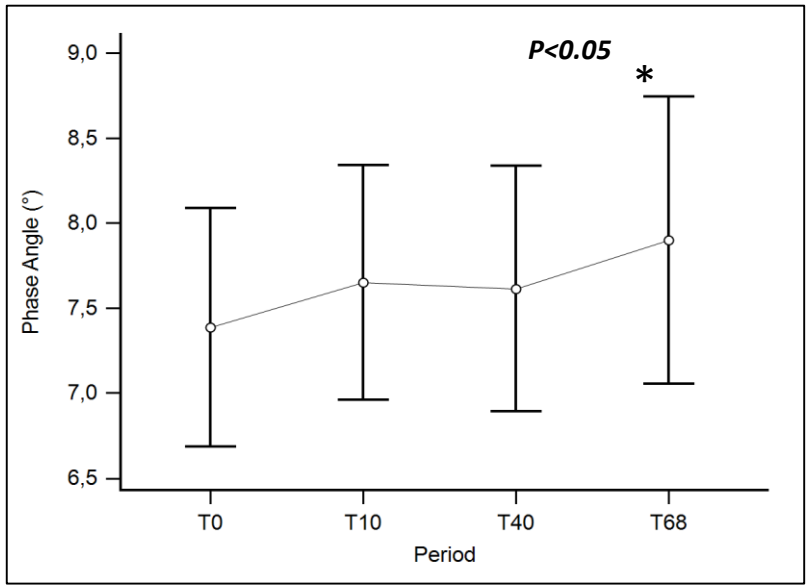
* significantly different from T10
\# significantly different from T40

Power output



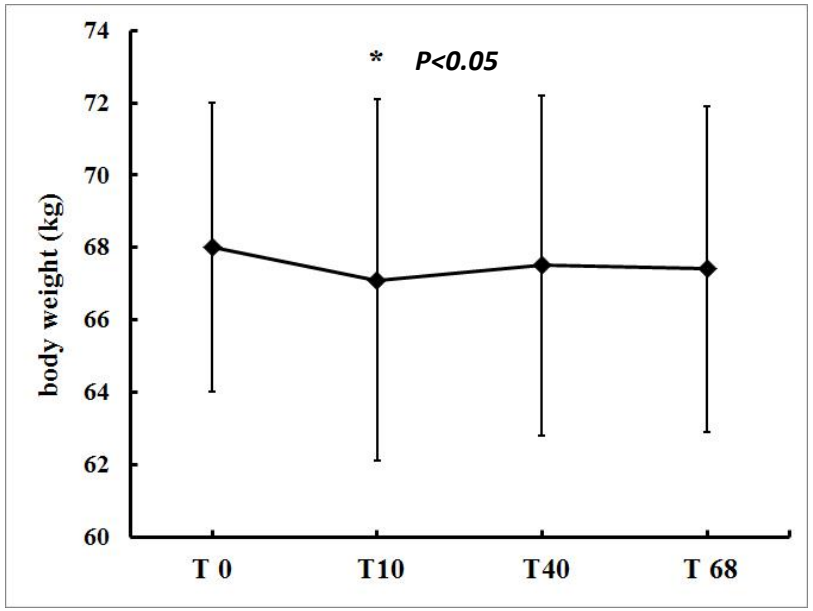
From T10 to T40 all significantly different
From T40 to T68 only P5m, P20m and P60m

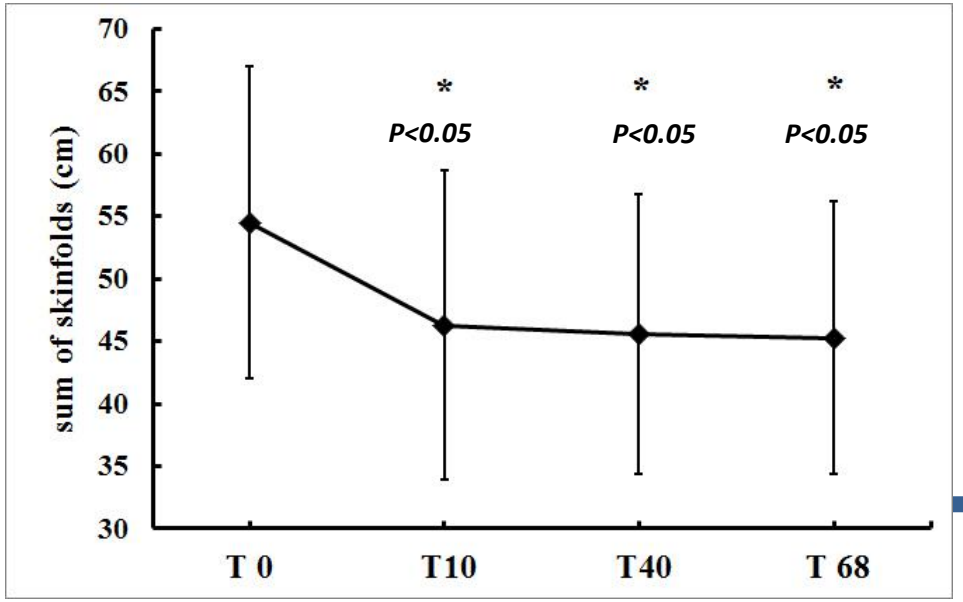
Body composition assessment



	T_0	T_{10}	T_{40}	T_{68}
Body weight (kg)	68±4.4	67.1±5*	67.5±4.7	67.4.6±4.5
Sum of skinfolds (mm)	54.5±12.5	46.3±12.4*	45.6±11.2*	45.3±10.9*
PhA (°)	7.4±0.6	7.6±0.7	7.6±0.7	7.7±0.8*

*Significantly different from T0





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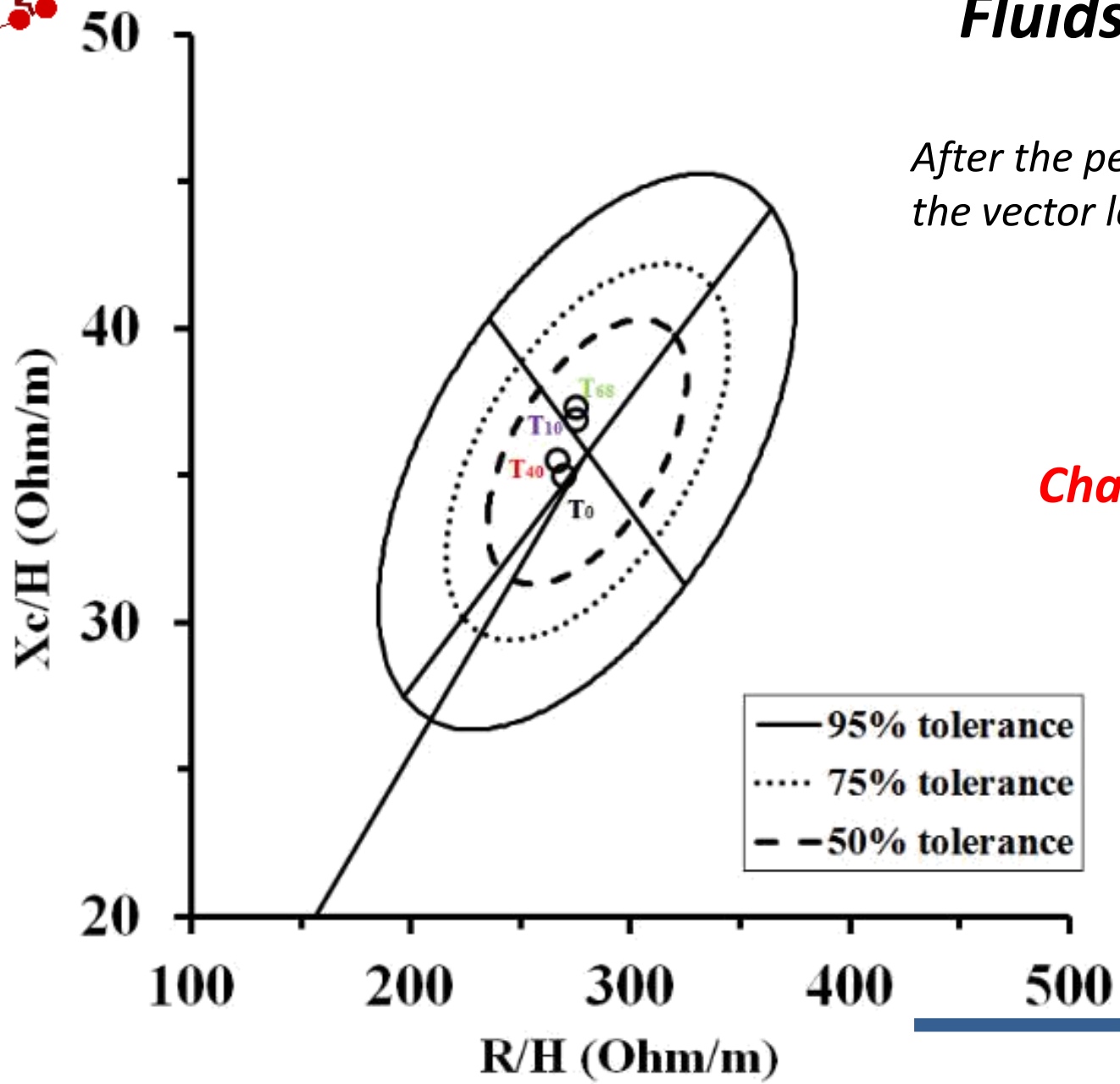
Fluids changes in pre-season

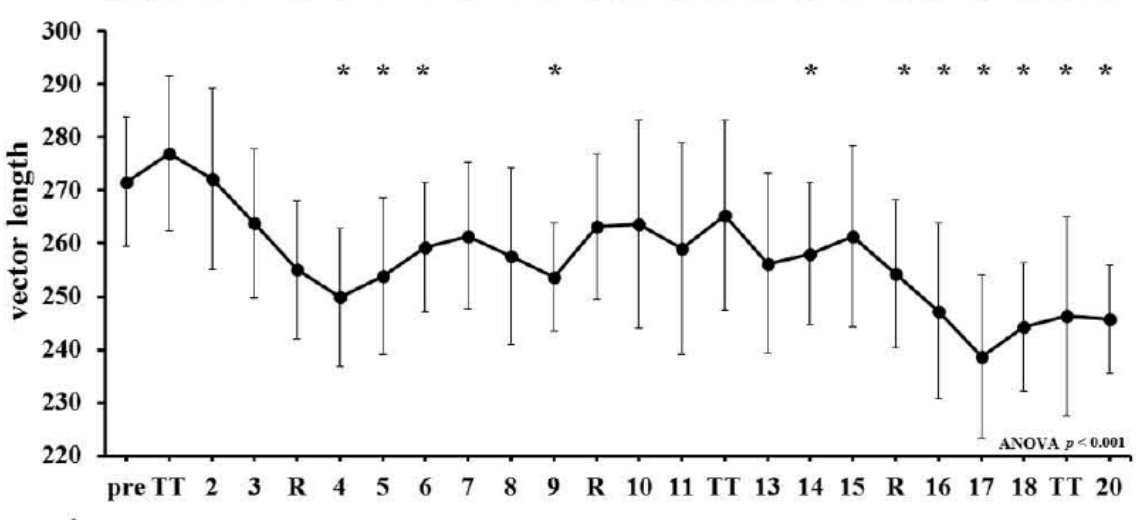
After the period with the highest external training load, the vector lenght decreased (more fluids).



Changes of impedance vector lenght may be a marker of internal workload ???

Impedance vector and External Workload

Body fluid status and physical demand during the Giro d'Italia



Pollastri et al; Research in Sports Medicine, 2016

A novel method to assess changes in body fluids: 2015 Giro d'Italia bioimpedance vector analysis experience

UNIVERSITÀ DI SIENA 1240

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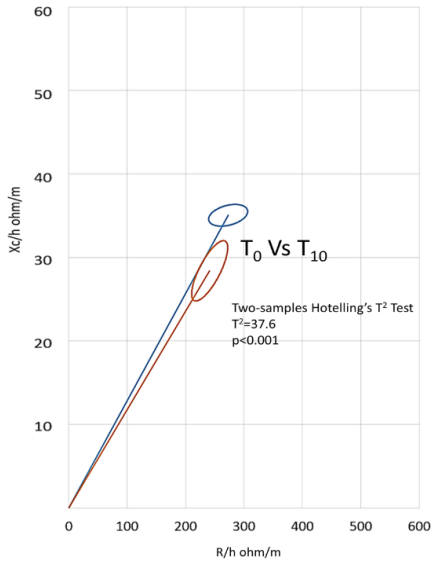

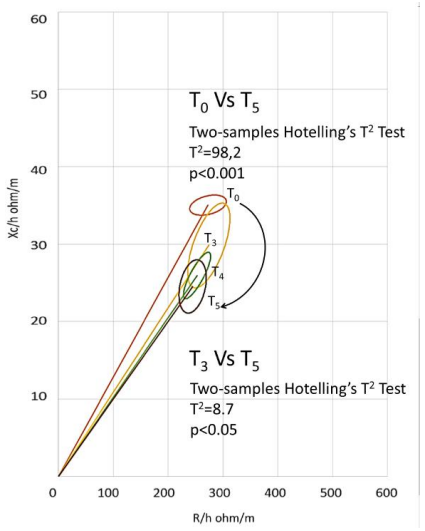

Endurance Research conference 2015 University of Kent

- ***Giorgi pre season BC assessment: in the morning in fasting condition***
- ***Pollastri BC assessment: 2 hours after the end of the stages***
- ***Giorgi BC assessment: 2 hours after the dinner, so about 6 hours after the end of the stages***

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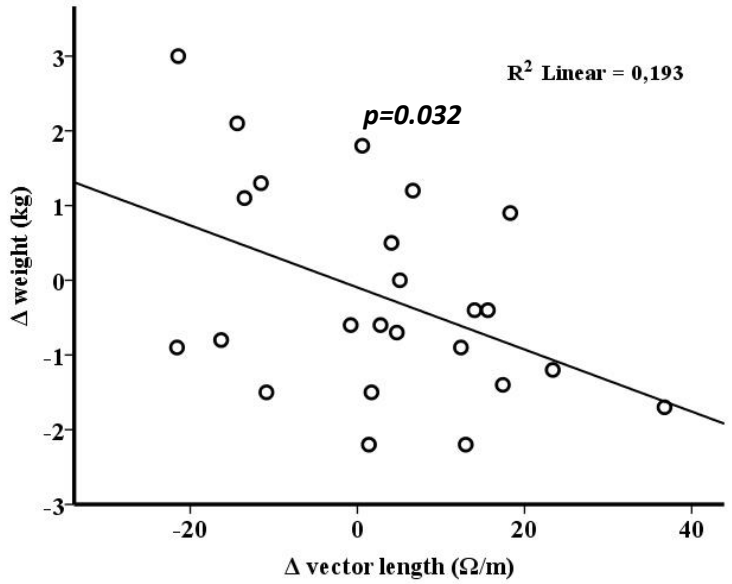
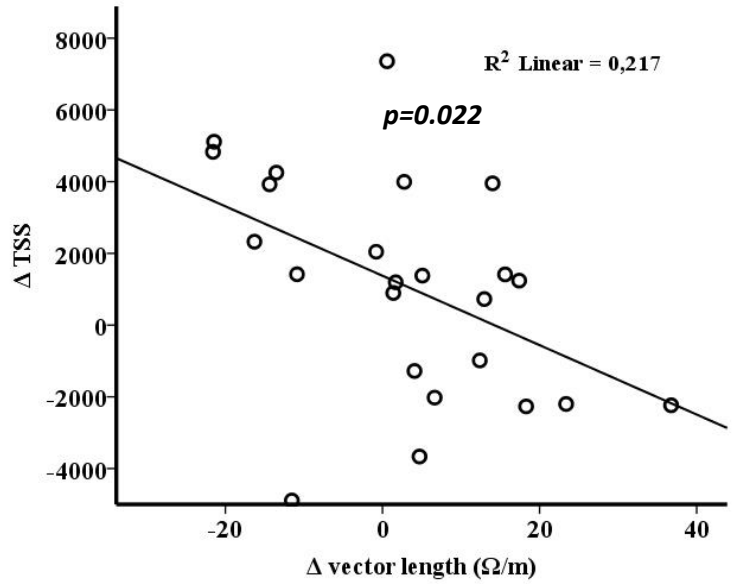
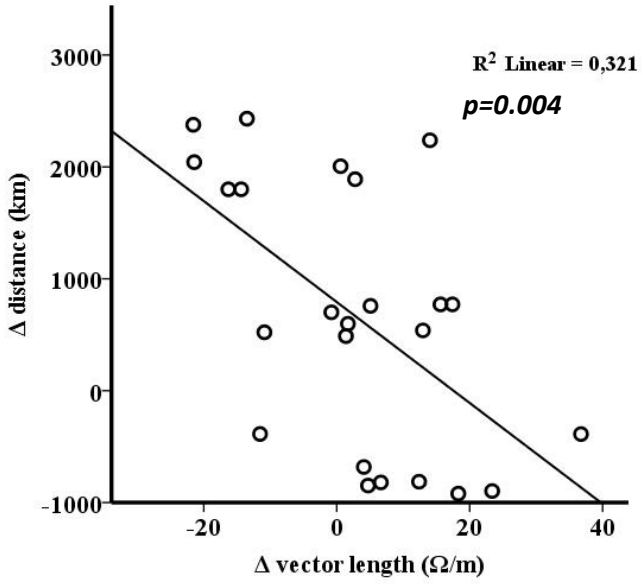
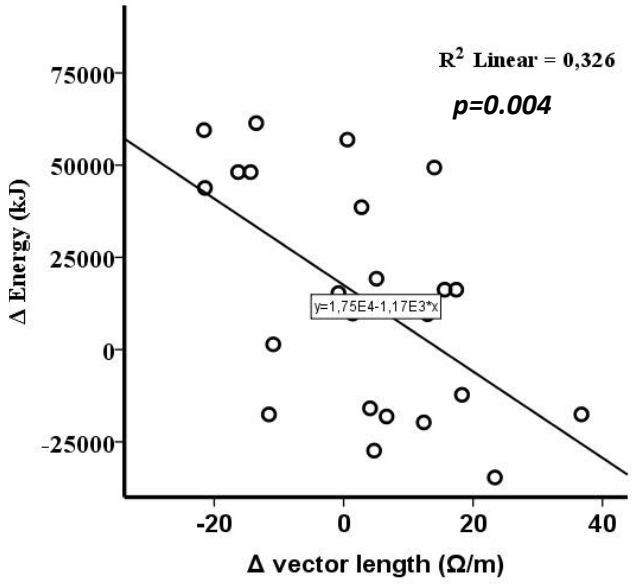
Bioelectrical values and External Workload

Negative correlation between external workload and vector lenght









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Conclusions

In December the cyclists trained more than in the others periods and rode at higher intensity with higher power output.

In this period, increased body fluids, phase angle and reactance without significative changes in body weight and sum of skinfolds.

The shape of body improved throughout the all period analyzed and body fluids increased during the hardest training period.

These results show that bioelectrical values can monitor the changes on body composition along with the changes in external training load.

Bioelectrical impedance is a practical method to monitor body water changes in response to physical training **avoiding false interpretation of body weight fluctuations**

BIVA detects with high sensitivity the intra-individual changes of body composition and can be used for longitudinal monitoring as well as to detect fast changes of body composition.