Proceeding

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Everesting challenge attempt strategy: A case study

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ABSTRACT

The Everesting challenge (repeat any hill, anywhere in the world, until you climb an altitude of 8848 m; the equivalent of M. Everest) is becoming an increasingly popular challenge. The physical and metabolic stress to which the body is exposed during this type of exercise is unusual and it is also particularly challenging for coaches, trainers and sport nutritionists. The aim of this study is to analyse the parameters and key details necessary to optimize a 10-week training protocol for an ultra-endurance performance like the Everesting challenge. An ex-élite cyclist, trained individual (male; 26 years; 181 cm; 71,7 kg; 21,9 BMI) followed a 10 weeks training and nutrition program to reach his peak performance and attempt the challenge. Body composition analysis checks (body weight, body circumferences, skinfold thickness and bioimpedance analysis) and performance tests (Conconi, Functional Threshold Power, Maximum Lactate Steady State) were planned at week 1, 5 and 10. After 10 weeks FTP increased from 245 to 267 W and at MLSS from 252 W to 270 W. Body weight decreased from 71,7 kg to 68,3 kg and body fat from 10,7% to 6,8 % (Jackson-Pollock 7 sites). The individual was able to accomplish the Everesting challenge concluding his ride in 13h34m27s, average power 162 W, average heart rate 139 bpm, 7685 kcal consumed. 10 weeks of strategically planned nutrition and training program may be sufficient to prepare an élite athlete or a well-trained individual to attempt an ultra-endurance challenge like the Everesting. **Keywords**: Cycling; Training; Ultra-endurance; Endurance.

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INTRODUCTION

The Everesting bike challenge (repeat any hill, anywhere in the world, until you climb an altitude of 8848 m, the equivalent of M. Everest) is becoming an increasingly popular ultra-endurance challenge. To date more than 3400 bike challenges have been successfully completed, with an attempt lasting from 10 to 24 hours. The optimisation of the athlete's performance before the attempt is particularly challenging for coaches, trainers and sport nutritionists.

In the last decade interest and participation in ultra-endurance events has increased significantly all over the world (Scheer, 2019; Knechtle and Nikolaidis, 2018).

An ultra-endurance activity is generally recognised as being exercise which lasts for more than 4 hours (Peters, 2003; Costa et al., 2019) or even more than 6 hours (Scheer, 2019). The physical and metabolic stress to which the athletes' bodies are exposed during activities like these is unusual and requires specially adapted nutritional and training support (Knechtle and Nikolaidis, 2018).

The athlete's nutritional status and level of energetic and nutritional support during training and competitions are associated with increases or decrements in exercise performance (Nikolaidis et al., 1995; Peters, 2003; Costa et al., 2018; Kerksick et al., 2018). Nutrition and its periodization are key factors in inducing and achieving functional metabolic adaptations and for improving substrate utilization during the activity (Costa, 2018; Jeukendrup, 2017). Proper nutrition is also fundamental to sustain the athlete energetically and structurally before, during and after training and competitions and to prevent and manage fatigue and gastrointestinal discomfort (Costa, 2018; Knechtle and Nikolaidis, 2018; Kerksick et al., 2018). Body composition analysis techniques coupled with performance analysis tests represent fundamental tools to evaluate the athlete's physical-metabolic condition as well as nutritional and muscular status and needs (Löllgen and Leyk, 2018; Lee et al., 2017; Bertuccioli et al., 2019, Heydenreich et al., 2017; Mazić et al., 2014; Beneke et al., 2011, Knechtle, B. 2014). Nikolaidis et al., 2019 reported how during preparation for an ultra-endurance competition the athlete's body composition is subject to marked changes, resulting mainly in a reduction in both body fat and fat free mass. Periodic body composition check-ups coupled with hydration status monitoring is fundamental to individuate the correct nutritional support and to periodize it in relation to the training and metabolic characteristics of the athlete.

Parallel with structured training programs, induced muscular and metabolic adaptations and finding the right pace to maximize performance, are also important physical-metabolic tests (Löllgen and Leyk, 2018).

However, an in-depth study, analysis or prediction of energetic-nutritional needs, fuel utilization and muscular-metabolic acute and chronic adaptions during an ultra-endurance event or preparation represents a complex challenge for researchers and/or sport science professionals (Rauch et al., 1998). Factors like the geographical location of the competition/trainings, the athlete's morphological and metabolic characteristics, the environment and unexpected race/training events, represent crucial variables impacting on exercise intensity and fuel utilization. Indeed, only a few studies reported direct data about ultra-endurance metabolic needs (Costa et al., 2018). Different studies analysed and reported the possibility of inducing specific metabolic adaptation through nutrition and training manipulation (Jeukendrup, 2017; Jeppesen and Kiens, 2012; Rauch et al., 1998; Costa et al., 2018 Burke et al., 2017; Volek et al., 2016). However, laboratory protocols in which exercise intensity, climate and other external factors (e.g. the emotive impact of a competition on the athlete) are standardized, may not always be representative of the athlete's real conditions during a competition/training and so unable to produce functional data to increase the athlete's performance.

Fat utilization adaptation can be considered potentially beneficial for a medium intensity, steady state performance typical of many of ultra-endurance challenges, however data about the benefits and disadvantages of low carbohydrate high fat protocols are controversial (Costa et al., 2018; Jeppesen and Kiens, 2012; Burke et al., 2017; Volek et al., 2016). Considering that central fatigue, muscle damage, hydration status, muscle glycogen and blood glucose content and availability are the main limiting factors for endurance performance, managing them with nutrition, and nutrient periodization during the athletic season could represent one of the best strategies to induce metabolic adaptations, as well as improve the body composition and performance of the athlete (Jeukendrup, 2017; Impey et al., 2018).

Therefore, considering what has already been published on this topic, the main aim of this study is to analyse the impact of a relatively short (10 weeks) performance optimization program on metabolic and body composition adaptation and on an ultra-endurance event performance for an ex-élite endurance athlete.

MATERIALS AND METHODS

Study Design

To study the impact of 10 weeks of nutritional and training optimization on an ultra-endurance bike event a longitudinal case study was structured in which an ex-élite athlete was monitored periodically (T1, T2, T3) (Figure 1).

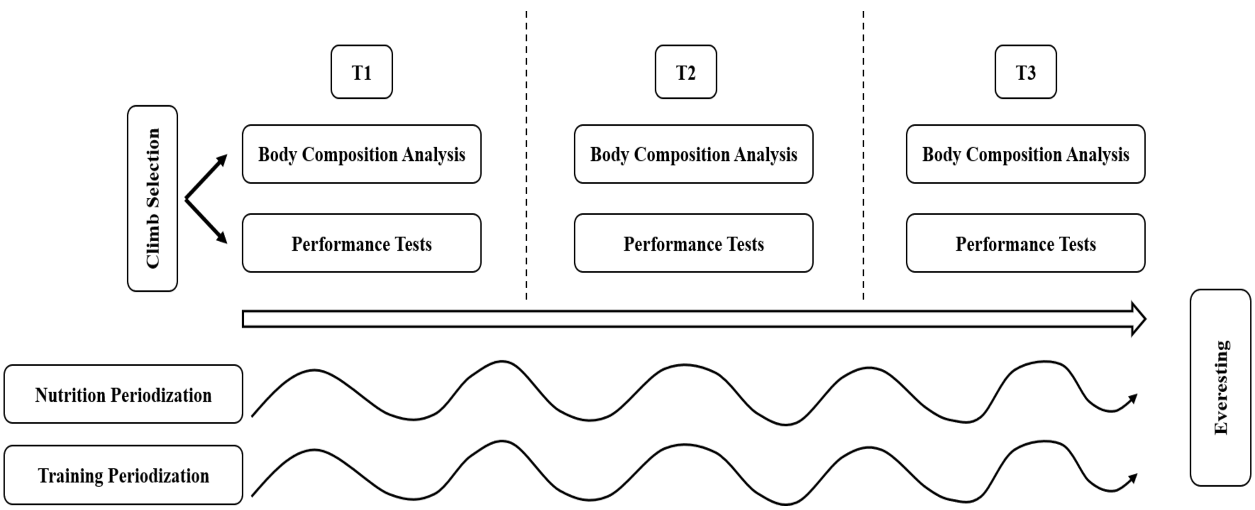

Figure 1. Study design.

Participant

We studied an ex-élite cyclist, well-trained individual (male; 26 years; 181 cm; 71,7 kg; 21,9 BMI) who has stopped competitive racing but continues to train occasionally. In March 2019 he asked our lab (NUTRICAM Food & Health) if it was possible to prepare for the Everesting challenge in 10 weeks (25/03/2019 → 09-06-2019), maximizing his performance. The subject (M.B.) voluntary accepted to participate in the study and signed informed consent after being informed of the testing procedures according to the Declaration of Helsinki.

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Nutrition periodization

Resting metabolic rate (RMR) was analysed at T1 through indirect calorimetry (COSMED FitMate PRO - COSMED Srl – Italy) following the methodology described by Compher et al., (2006). Daily caloric and macronutrients uptake was structured considering training volume and characteristics. In the first phase (T1 → T2) a caloric deficit was planned with low carb high fat as the prevalent dietetic approach. In the second phase (T2 → T3) calories progressively increased until the final week before the competition in which a caloric load was structured. In the second phase macronutrients uptake was strictly related to training goals.

Body composition evaluation

Body composition analysis checks were planned at T1, T2 and T3. Anthropometric data was collected following standardized international procedures. Body weight was measured using a mechanical balance scale (seca 813). Body circumferences were taken using a non-stretchable fiberglass insertion tape in different sites: abdomen, chest, left and right arms (both relaxed and contracted), left and right thigh (proximal, mid and distal) and left and right calf. Skinfold thickness was measured using a GIMA skinfold calliper, at different sites on the right site of the body: triceps, biceps, mid-axillary, chest, subscapular, abdominal, suprailiac, thigh, calf as described in NHANES manual (Centers for Disease Control and Prevention, 2007; Madden and Smith, 2016). Percentage of fat mass was estimate using 3 and 7-sites Jackson and Pollock equations (Jackson and Pollock, 1978). Tri-compartmental body composition was evaluated using Bioelectrical Impedance (BIA) using single-frequency bioimpedence (BIA AKERN 101, 50 kHz, AKERN, Florence, Italy). An analysis of the value of resistance and reactance was carried out using BodyGram Plus© software. Total Body Water (evaluating TBW); Extra and Intra Cellular Water (ECW; ICW); Phase Angle (PA) and Body Cell Mass (BCM) were considered (Piccoli et al., 1994).

Training periodization

After choosing the hill (Monte Conero - Ancona, Italy – 3,7 km, 374 m, 10%) the first tests were planned to analyse climbing time and climbing effort. In the first phase (T1 → T2) the main training goals were to increase endurance capacity and in particular to sustain constant medium intensity workloads in progressively longer distance trainings (Zaryski et al., 2005; Hofmann and Tschakert, 2017). In the second phase (T2 → T3) the focus was on increasing lactate tolerance and anaerobic threshold, finding the right cadence (rpm) and rhythm/workload (km/h – W) to cycle up Monte Conero 24 times. The week before the competition a progressive training deloading was planned.

Testing protocols

Performance tests were planned at T1, T2 and T3. Power output (W) was measured through a crankset power meter (© Stages Cycling, LLC 2018), heart rate (bpm) and training data was acquired using a cyclocomputer (Bryton Rider 530 - Bryton Inc. 2017), blood lactate levels were measured using a blood lactate test meter (Lactate Pro™ 2 LT-1730; Arkray Inc., Japan). A Conconi incremental test was performed on a cycle ergometer (Excite Bike Med - TECHNOGYM®) (Conconi et al., 1996). A Functional Threshold Power (FTP) 1-hour test was performed standardizing the route, weather conditions and time of day (Allen et al., 2019). Maximum Lactate Steady State Test was performed on consecutive days on the hill selected for the competition (Hoogeveen et al., 1997; Beneke, 2003; Billat et al., 2003). All the tests were performed after a "recovery" (active recovery training session) day.

Challenge attempt strategy

Based on data collected over the 10 weeks and from the tests performed, our goal was to conclude the challenge in less than 15h. We set the climbing power output to 65% of the FTP, hypothesizing a possible 5%/h decrement in performance from the FTP 1h test performed and considering MLSS tests (Perez et al., 2012). During the challenge the athlete remained constantly in contact with us and we were able to assess any pace increases or reductions. At the top of the climb and at the bottom of the descent two refreshment points were placed where the athlete was able to consume meals and scheduled supplies.

Data Analysis

Given the nature of the study, only a qualitative analysis was performed. All data analyses were carried out using GraphPad Prism version 7.0 (GraphPad Software, San Diego, CA, USA).

RESULTS

The athlete was able to accomplish the Everesting challenge concluding his ride in 13h34m27s, average power 162 W, average heart rate 139 bpm and 7685 kcal consumed. Climbing data is represented in figure 2. The athlete lost 1,3 kg of body weight from the start to the finish of the attempt. Calories consumed were estimated to be about 5840 kcal of which 45% carbohydrates, 14% proteins and 40% fats. The athlete consumed about 9 litres of water plus 4 litres of water with mineral salts and/or carbohydrates.

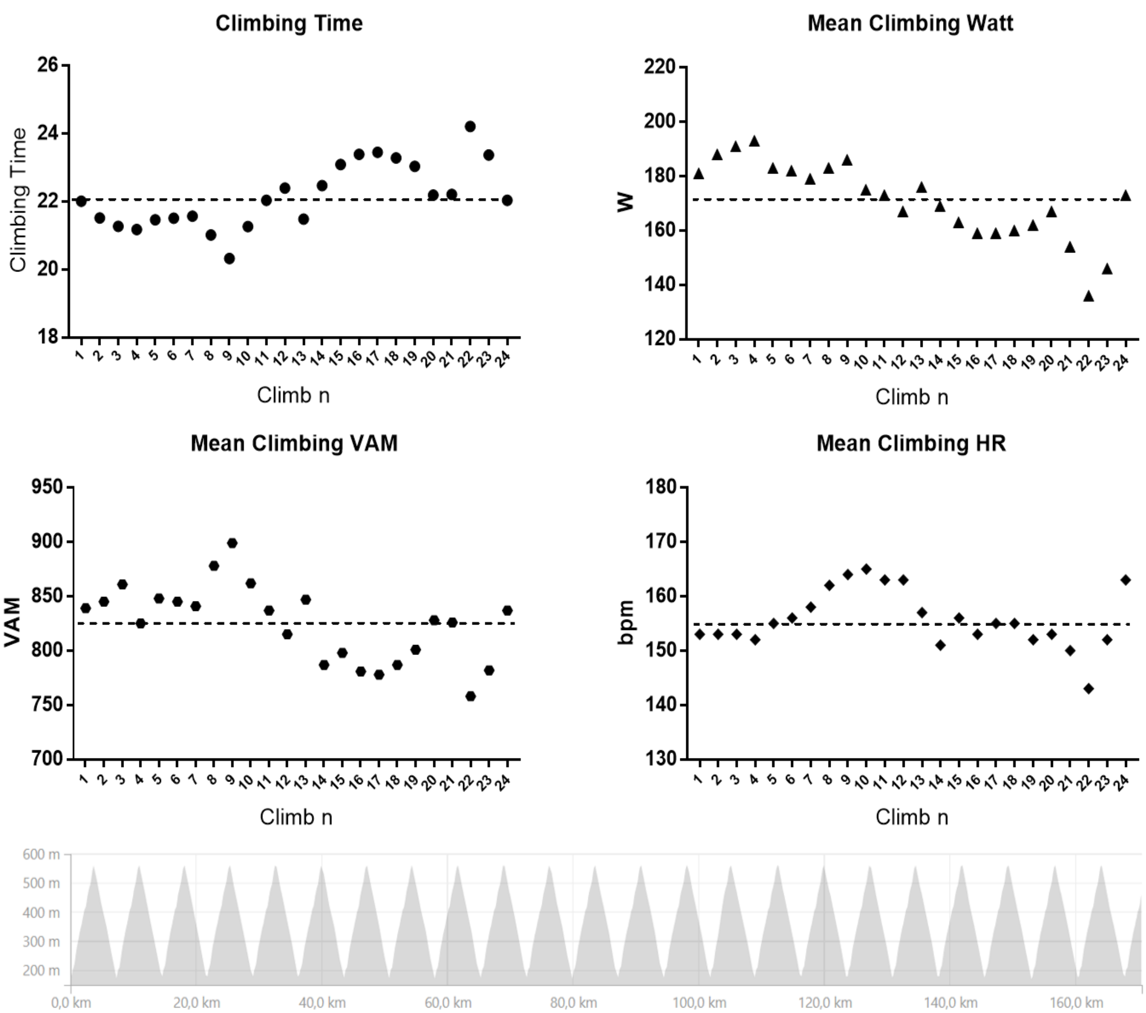

Figure 2. Challenge attempt climbing data.

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Body Composition

Body weight decreased by 3.4 kg from T1 to T3 (table 1). Total Body Water (TBW) and in general hydration status (TBW, ECW, ICW) of the athlete was maintained constant during the 10 weeks. Body Cell Mass (BCM) and Phase Angle remained unchanged (figure 3).

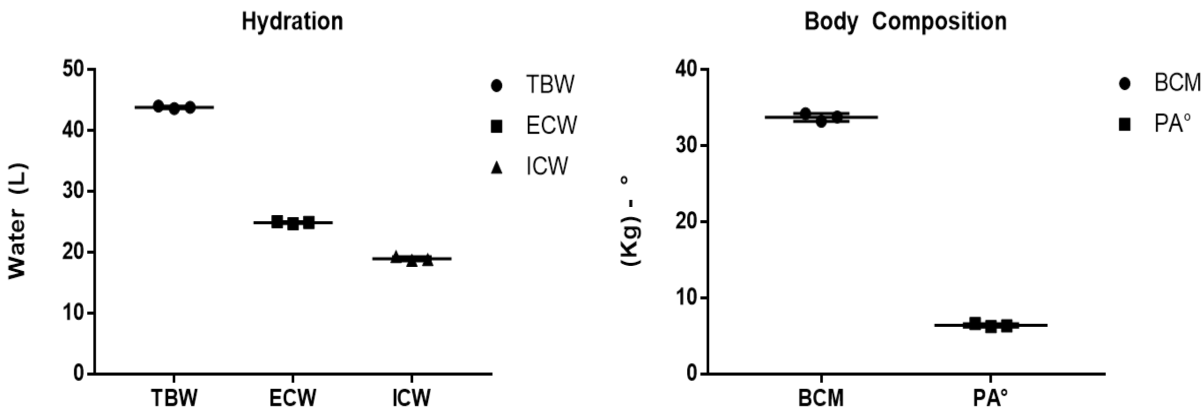

Figure 3. Bioimpedence analysis data (hydration and body composition markers).

Skinfold sum (SUM7) and, parallelly, Body Fat percentage (BF%) decreased in the first phase (T1→T2) then stabilized in the second phase of the program (T2→T3) (table 1, figure 4). Also, body circumferences decreased from T1 to T2 and then remained stable from T2 to T3 (table 1).

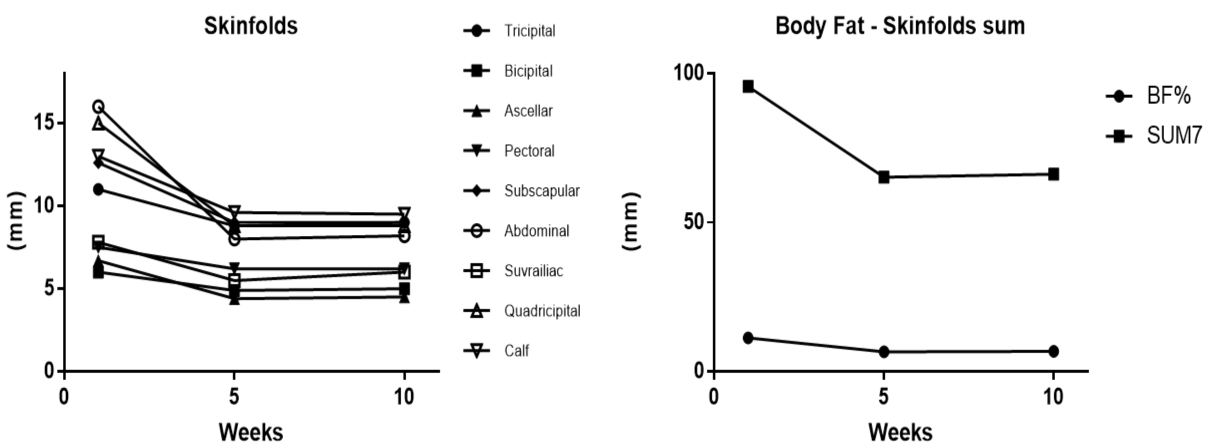

Figure 4. Skinfold thickness and body fat changes during the 10-week program.

Table 1. Body composition changes from T1 to T3.

		Body Composition			
		T1	**T2**	**T3**	**Δ**
Body Weight (kg)		71.7	68.8	68.3	-3.4
Bioimpedence Analysis	BCM (kg)	33.2	33.8	34.2	+1
	PA°	6.2	6.3	6.6	+0.4
	TBW (L)	44.00	43.8	43.6	-0.4
	ICW (L)	24.7	25.00	24.9	+0.2
	ECW (L)	19.3	18.8	18.7	-0.6

Skinfolds (mm)	Tricipital		11.00	8.8	8.9	-2.1
	Bicipital		6.00	4.9	5.00	-1
	Ascellar		6.7	4.4	4.5	-2.2
	Pectoral		7.5	6.2	6.2	-1.3
	Subscapular		12.6	9.00	9.00	-3.6
	Abdominal		16.00	8.00	8.2	-7.8
	Suvrailiac		7.8	5.5	6.00	-1.8
	Quadricipital		15.00	8.8	8.8	-6.2
	Calf		13.00	9.6	9.5	-3.5
Body Circumferences (cm)	Waist		75.00	73.2	72.1	-2.9
	Chest		91.00	89.3	89.00	-2
	Bicep dx	Relaxed	29.00	27.8	28.00	-1
		Contracted	31.5	29.2	29.4	-2.1
	Bicep sx	Relaxed	31.5	29.2	29.4	-0.9
		Contracted	28.00	27.00	27.1	-1.3
	Leg dx	Proximal	53.4	51.2	51.00	-2.4
		Mid	53.00	51.5	51.2	-1.8
		Distal	44.3	43.2	43.00	-1.3
	Leg sx	Proximal	53.4	51.00	51.00	-2.4
		Mid	53.00	50.8	50.7	-2.3
		Distal	44.2	43.2	43.1	-1.1
	Calf dx		37.00	36.00	36.00	-1
	Calf sx		37.00	36.00	36.00	-1

Performance

Power output at 4 ± 0.3 mmol during the MLSS test increased from T1 to T3 (+18.0 W) (table 2, figure 5). FTP increased from T1 to T3 (+22.0 W) and, also Conconi's test threshold power (+31.0 W) (table 2, figure 5). Power (W) globally increased progressively during the entire program.

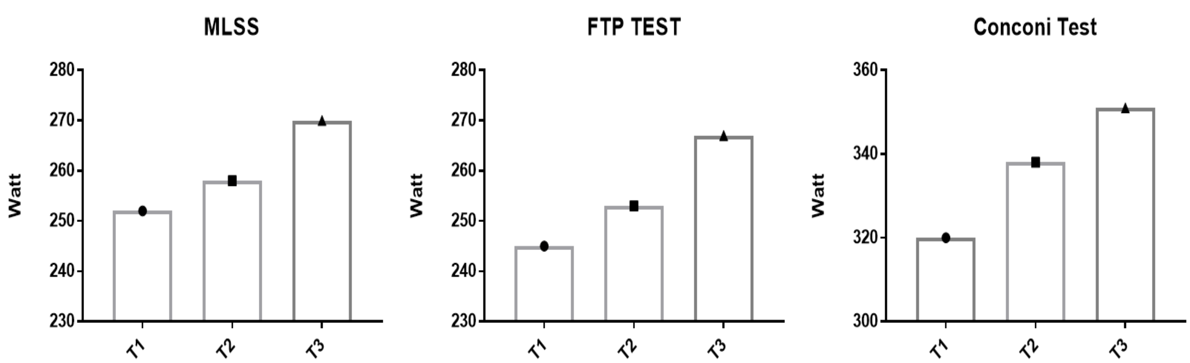

Figure 5. Performance test results at T1 (week 1), T2 (week 5) and T3 (week 10).

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Table 2. Physical condition test results from T1 to T3.

		Performance Tests			
		T1	**T2**	**T3**	**Δ**
MLSS	BLC (mmol/L)	4.1	4.3	4.2	+0.1
	Power (W)	252.0	258.0	270.0	+18.0
	HR (bpm)	162.0	165.0	164.0	+2.0
FTP	Power (W)	245.0	253.0	267.0	+22.0
	HR (bpm)	160.0	163.0	162.0	+2.0
Conconi Test	HR (bpm)	191.0	189.0	187.0	-4.0
	Workload (W)	320.0	338.0	351.0	+31.0

DISCUSSION

Preparation of an ultra-endurance challenge requires strategically and meticulously planned nutrition and training programs. Our data demonstrates how by periodizing nutrition in relation to training (Jeukendrup, 2017) it is possible to achieve body composition adaptations even in a short period of time. Parallelly how by periodizing training (Allen et al., 2019) in relation to nutrition it is also possible to maximize adaptations in a short period of time.

Considering our aim, the main findings of the present study are related to the achievements in terms of body composition and training adaptations over a relatively short period of time.

In the first phase, in which a caloric deficit was set, and the main focus was on nutrient functional utilization adaptation and on aerobic capacity improvement, it was possible to achieve functional metabolic and body composition adaptations (reduction of BF%, maintenance of BCM and TBW). Once the objectives related to body composition had been achieved the main focus was on performance optimization and on globally improving physical condition. Functional power but also aerobic capacity increased progressively from T1 to T3.

Monitoring by using body composition analysis techniques (Bertuccioli et al., 2019; Heydenreich et al., 2017) and performance analysis tests (Löllgen and Leyk, 2018) is fundamental to properly establish and to collect feed-back on nutrition, supplementation and training. Monitoring the athlete's progress and adjusting variables day by day, it is possible to prepare an ultra-endurance event, for an experienced athlete, even in a relatively short period of time.

CONCLUSIONS

Ten weeks of strategically planned nutrition and training may be sufficient to prepare an élite athlete or a well-trained individual to attempt an ultra-endurance challenge like the Everesting Challenge.

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