

Original Article (short paper)

Performance comparison in the Wingate test between standing and seated positions in competitive cyclists

Renato Rohsler¹ , Fernando de Souza Campos² , Pedro Rafael Varoni¹ ,
Lucielle Baumann¹ , Michelli Demarchi¹ , Anderson Santiago Teixeira² ,
Ricardo Dantas de Lucas² , Renan Felipe Hartmann Nunes³ , Lucinar Jupir Forner Flores¹ 

¹Universidade Estadual do Oeste do Paraná, Cascavel, PR, Brasil.

²Universidade Federal de Santa Catarina, Florianópolis, SC, Brasil.

³Clube Atlético Tubarão, Departamento de Fisiologia, Tubarão, SC, Brasil.

Abstract - Aims: The current study aimed to compare the anaerobic power output through the Wingate test in different positions, i.e., standing and seated, and identify the relationship between power-output and body mass. **Methods:** Eleven male competitive cyclists (age: 30.3 ± 4.7 years; body mass: 73.7 ± 7.7 kg; body fat: $11.3 \pm 4.2\%$) were submitted to two sessions of the Wingate test (WT) in different positions, on different days. **Results:** The peak power (W), average power (W), relative peak power ($\text{W}\cdot\text{kg}^{-1}$), relative average power ($\text{W}\cdot\text{kg}^{-1}$), average cadence (rpm), and average velocity ($\text{km}\cdot\text{h}^{-1}$) presented significant differences in the standing position compared with the seated position ($p < 0.05$), 1155 ± 130 vs. 1082 ± 182 (W), 875 ± 96 vs. 818 ± 116 (W), 15.9 ± 1 vs. 15.0 ± 2 ($\text{W}\cdot\text{kg}^{-1}$), 12.1 ± 1 vs. 11.3 ± 1 ($\text{W}\cdot\text{kg}^{-1}$), 117.5 ± 7 vs. 109.8 ± 10 (rpm), 37.0 ± 2 vs. 34.6 ± 3 ($\text{km}\cdot\text{h}^{-1}$), respectively. However, when controlled the body mass, the differences in variables power output ceased to exist ($p > 0.05$). The fatigue and peak heart rate (bpm) indices did not present significant differences between the tests ($p > 0.05$). **Conclusions:** Sprint performance was improved when the WT was performed in a standing position in competitive cyclists. The study also reports the important relationship between body mass and anaerobic production capacity in the WT, emphasizing that it is desirable an increase in lean body mass and a reduction in fat mass, similar in competitions. We suggest that, for anaerobic assessment in cyclists, the standing position should be used during the WT, to determine the maximum power-output capacity.

Keywords: athletic performance, bicycling, exercise test.

Introduction

The characteristics of competitive cycling include endurance aerobic actions for long periods of races in different types of landscape, that request decisive (accelerations, attacks, and sprints) actions mainly from the anaerobic system to supply energy, to produce greater force and power¹. Therefore, the anaerobic pathways are present in actions such as start, climbs, and sprints, as well as, primarily, in final moments of the competition, characterized as short term and high-intensity events. In this case, rapid energy-producing pathways are required to supply the needs of these actions, resulting in high metabolic demand and high power production on the pedals². In addition, athletes performed several high sprints in the course of a race, resulting in elevated levels of anaerobic power production³.

A factor that influences individual response is related to the modes of power production for the force to be applied to the pedals. The magnitude of effort applied and orientation determines the force production which results in movement and, subsequently, the individual pedaling

standard⁴. Therefore, the Wingate test (WT) is an anaerobic exercise test, most often performed on a stationary bicycle, that measures peak anaerobic power and anaerobic capacity⁵. It has been utilized in different populations^{1,6,7}, especially to evaluate anaerobic performance in an all-out 30-s sprint (i.e., high-intensity effort). The data provided from this test are: peak power (PP), normally obtained in the initial seconds, average power generated during the test (AP), and the fatigue index (FI) which consists of performance reduction between the maximum and minimum power output⁵.

The main recommendation in the execution of the WT is the position of the cyclist on the saddle, who should remain seated from the initial moment of acceleration of the pedals until the end of the test^{8,9}. However, in race situations, there is a possibility of creating greater power according to the adopted position of the cyclist, that is, standing or seated^{6,7}. Reiser et al.⁶ observed an increase in PP when the WT was conducted with the cyclist standing, although subsequent studies did not find an effect of position on power production^{1,7}. Since the WT aims to evaluate the maximal anaerobic power, the test proposes

standardization so that the athlete remains seated throughout the protocol. However, in competition situations, the moments of higher power output are performed with the athlete in a standing position (start, sprint, attacks, long stretches with elevation, and ending the race). Therefore, athletes must be evaluated in these conditions to verify that the maximal anaerobic power produced during the WT is close to that produced in a competition.

Taking into consideration the importance of determining differences between positions, the primary objective of the present study was to compare the power production through the WT in the standing position concerning the seated position in competitive cyclists, and the secondary objective was to identify the relationship between body mass and the power variables obtained in the test. The hypothesis was that athletes in a standing position would produce a greater power index in the WT when compared to a seated position.

Methods

The sample of the present study (Table 1) was composed of eleven male competitive cyclists who participated in road cycling races at state, national, and international levels. All volunteers were previously informed of the risks and benefits of the study and familiarized with the experimental procedures in the laboratory. The study was approved by the Institutional Ethics Committee for Research on Human Subjects (number CAAE: 33095714.3.0000.0107) and performed following the standards established by the Declaration of Helsinki.

The study participants trained between 5 and 6 days per week with session durations of between 1 and 4 h. The training was based on strategies such as training at high-intensity using repeated sprints with variations in the gears (heavy and light), specific training in climbs with durations of 10 to 20 min (between 5 to 10 repetitions), as well as training sessions in a circuit and time-trial, being performed between 2 and 3 days a week. The moderate-intensity training was characterized by a course with a long distance (over 3 h).

All participants were submitted to anthropometric evaluations and two experimental sessions in the WT

(standing and seated) with an interval of 24 h between sessions. In both conditions, the laboratory environmental temperature between 22 and 24 °C, relative humidity between 60 and 70%, and atmospheric pressure (724 mm Hg) were similar, as well as the time of the performance test. During the evaluations, water consumption was allowed *ad libitum*. All participants were instructed not to perform a physical exercise on the day before evaluation and not to consume foods with high energy content or drinks containing caffeine for three hours before the start of the sessions.

Anthropometric measurements of body mass and height were performed using a scale with a resolution of 0.1 kg (Model 2096, Toledo, Brazil) and stadiometer with a resolution of 1 mm (Standard, Sanny, Brazil). In addition, four skinfolds were measured using a scientific caliper with a resolution of 1 mm (Cescorf, Brazil), according to the protocol proposed by Jackson and Pollock¹⁰: abdominal, supra-iliac, tricipital, and thigh.

A cycle ergometer was utilized (Cefise, model Biotec 2100, Brazil), which allows biomechanical adjustment during the execution of the test, through the triangulation between handlebar, saddle, and crank, being positioned according to the individual characteristics of each athlete. The cycle ergometer used is equipped with mechanical braking connected to a microcomputer. Data collection and analysis were performed through Ergometric software (Cefise, Brazil). A heart rate monitor was used in all tests (model S610, Polar, Finland).

The order of WT was randomized (<http://www.randomization.com>) and counterbalanced. At the first moment the athletes were divided into two groups to perform the first test in the standing position (n = 6) or seated position (n = 5). After respecting 24 h of the interval, the volunteers returned to the laboratory to perform the test in the other position. Athletes were informed of the position in which they would perform the test a few minutes before the test. Resistance utilized in the WT was relative to 10% of body mass using the measurements obtained immediately before each session⁵.

The WT was preceded by a warm-up of 5 min in approximately 100 rotations per minute (rpm) on the cycle ergometer, with 2 sprints of approximately 6 s every minute, followed by a 2-min rest interval before the start of the test¹¹. All athletes wore their cycling shoes. Both tests had a duration of 30 s and the athletes were verbally motivated to perform at the fastest rate possible to complete the test. The seated WT consisted of the athlete remaining seated throughout the test, that is, supporting their hands, feet, and hips on the cycle ergometer. The standing WT consisted of the athlete remaining without the support of the saddle throughout the test, that is, only supporting their hands and feet on the cycle ergometer. Variables provided by the software during WT were: peak power (PP), average power (AP), average cadence (AC), average speed

Table 1 - Descriptive data of the study athletes.

Variables	Mean	SD	Lower	Upper
Age (years)	30.0	4.8	18.0	38.0
Body Mass (kg)	72.1	5.5	62.0	82.3
Height (m)	1.76	0.04	1.7	1.8
Fat Percentage (%)	10.6	3.7	5.0	16.2
Fat Mass (kg)	7.84	3.1	3.4	12.8
Lean Mass (kg)	64.3	3.8	56.1	69.8
Weekly training (h)	16.4	5.6	13.2	20.4

Note: kg = kilograms; m = meters; h = hours.

(AS), and fatigue index (FI). Relative peak power (RPP) and relative average power (RAP) was calculated according to the body mass of each athlete ($PP/BM=RPP$; $AP/BM=RAP$), and peak heart rate (PHR).

All data are expressed as mean \pm SD. Data normality was assessed through visual inspection and the Shapiro-Wilk test. To compare the WT between the positions, the paired student t-test was used. Multivariate analysis of covariance (MANCOVA) with a post hoc of Bonferroni was realized to determine the differences between groups, using body mass as a covariate. This procedure was chosen with the intent of removing the influence of body mass on power production. To verify the relation between body mass and the delta power variable in the test, the Pearson correlation was used for analyzes. Results were considered significant at $p < 0.05$. The statistical software SPSS, version 19.0, was utilized for data analysis.

Results

Table 1 presents the general characteristics of the study sample, expressed as mean and SD.

Standing position presented greater values in variables PP ($p = 0.019$), AP ($p \leq 0.001$), RPP ($p = 0.033$), RAP ($p \leq 0.001$), AC ($p \leq 0.001$), and AS ($p \leq 0.001$),

presented significant differences compared with the seated position. No significant differences were found for variables FI ($p = 0.710$) or PHR ($p = 0.279$). Controlling for body mass as a covariate, significant differences were observed for AC ($F = 5.385$; $p = 0.030$) and AS ($F = 5.391$; $p = 0.030$). No significant differences were found for variables PP ($F = 3.127$; $p = 0.092$), AP ($F = 4.235$; $p = 0.052$), or FI ($F = 0.200$; $p = 0.660$) (Table 2).

Figure 1 presents the correlations of body mass and delta (Δ) differences between WT positions for the variables RAP, AS, and AC, which all presented significant correlations with body mass, $r = -0.71$; $p = 0.01$, $r = -0.71$; $p = 0.01$ and $r = -0.71$; $p = 0.01$, respectively.

Discussion

The present study aimed to compare power production between different positions in the WT in competitive cyclists. The main finding demonstrated that the standing position in the WT presented greater power production concerning the seated position in the variables PP, AP, RPP, RAP, AC, and AS. These findings confirm, in part, the main hypothesis of the study that the standing position would result in greater power production compared with the seated position.

Table 2 - Variables obtained in the Wingate Test in both positions.

Variables	Mean \pm SD			MANCOVA	
	Seated	Standing	P-value	F	p-value
Peak Power (W)	1082 \pm 182	1155 \pm 130*	0.019	3.127	0.092
Average Power (W)	818 \pm 116	875 \pm 96*	0.000	4.235	0.052
Fatigue Index	44.4 \pm 12	42.9 \pm 3	0.710	0.200	0.60
Relative Peak Power ($W \cdot kg^{-1}$)	15.0 \pm 2	15.9 \pm 1*	0.033	-	-
Relative Average Power ($W \cdot kg^{-1}$)	11.3 \pm 1	12.1 \pm 1*	0.001	-	-
Average Cadence (rpm)	109.8 \pm 10	117.5 \pm 7*	0.000	5.385	0.030*
Average Speed ($km \cdot h^{-1}$)	34.6 \pm 3	37.0 \pm 2*	0.000	5.391	0.030*
Peak Heart Rate (bpm)	176.6 \pm 7	178.7 \pm 3	0.279	0.721	0.405

Note: W = watts; $W \cdot kg^{-1}$ = watts/kilograms; rpm = rotations per minute; $km \cdot h^{-1}$ = kilometers per hour; bpm = beats per minute. Values expressed as mean \pm standard deviation. *significant differences when compared to WT seated at the level $p < 0.05$.

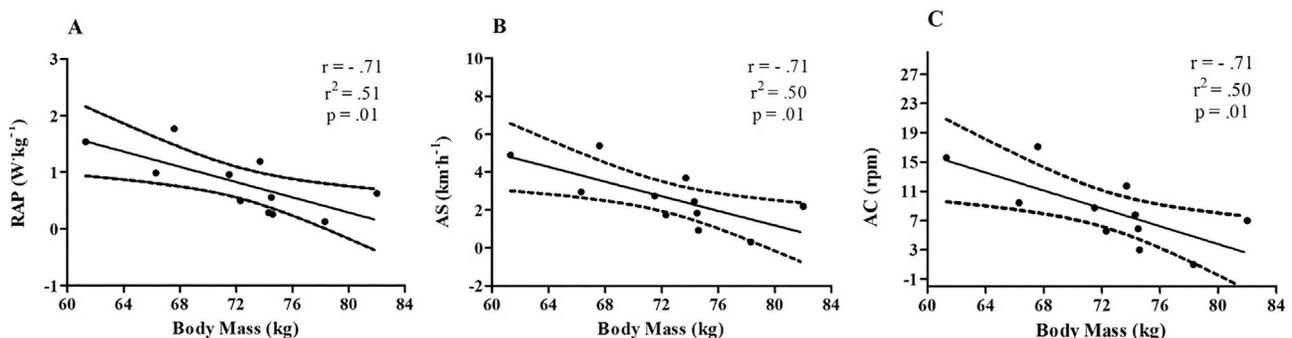


Figure 1 - Coefficient of the correlation between body mass (kg) and delta (Δ) of the variables relative to the average power (RAP) ($W \cdot kg^{-1}$) (Figure 1A), average speed (AS) ($km \cdot h^{-1}$) (Figure 1B), and average cadence (AV) (rpm) (Figure 1C).

Until now, the relationship between the power produced in different positions remains unclear, and the present study provides important results reinforcing this discussion. For example, Wilson et al.⁷ did not report differences between positions in the variables PP and AP. Differently, Reiser et al.⁶ demonstrated differences in variables PP and AP, however, the authors did not report the differences in AC between positions. Mclester et al.¹ in a protocol with three repetitions of WT with a four-minute recovery reported differences for AP and FI in the third test. In this regard, the authors affirmed that these differences in variables between positions are achieved in the initial 5 s of the test, is the result of higher recruitment of the muscles, increasing energy transfer to the pedals, as well as interference from the amplitude of movement and articulations of the standing position compared with the seated position^{12,13}. More recently, Merkes et al.¹⁴ investigated differences among three positions of WT (seated, standing, and forward standing). Standing and forward standing (attack positions) were different of seated position in higher peak power and mean power output, nevertheless, in competition the forward position shown its aerodynamic benefits when compared to seated and standing positions.

The RAP and AS presented differences between positions, however, we did not find any other studies that approached these variables utilizing the WT. According to Wilson et al.⁷, these findings are directly related to the sample characteristics, level of training, individual technique, a specificity of the sport, and levels of muscular activation^{1,6}. Other interesting data in the present study were the influence of body mass on the power production capacity in the WT, as the significant differences ceased to exist when body mass was used as a covariate (i.e., PP and AP). Thus, the findings of Kim et al.¹⁵ emphasized that for a better index of anaerobic power in the WT, an increase in lean body mass and reduction in fat mass are necessary, presenting better use of muscular fibers indispensable for contraction. In this way, an excess of body fat presents disadvantages in sports performance¹⁶.

As regards mechanical differences between positions, studies show that the standing position presents better redistribution of the energy of the upper body forward during realization of the WT, becoming a determinant factor of performance¹⁷. Furthermore, the authors related that the linear movement increased in cyclists in the standing position when compared with the seated position. Neptune and Hull¹⁸ affirm that energy generated resulting from rising in the saddle, to increase the force imposed by the hip joint, classified as a linear movement, is fully transferable to the pedaling movement, and maybe one of the determinant factors in the WT results between positions.

Therefore, the generated power output in the standing position is usually better compared with the seated position, however, it is difficult to maintain this position

for a long period, due to the high demand for neural recruitment in upper and lower body muscles^{13,19}. Regarding the energy cost, Costes et al.²⁰ affirmed that there are smaller alterations in the relationship of the position adopted (seated vs. standing), however, the protocol used was different from the present study. This technique can be utilized to reach or overtake an adversary, win a short and very steep climb, or vary the position on long climbs, thus, the standing position facilitates generation of better workload, better force production, and pedal cadence⁷, according to the present study.

Consequently, when WT was performed in the seated position, athletes have three bases of support: handlebar, saddle, and pedals, dividing the load, however, when the support of the saddle is eliminated in the standing position, the mass moves in the direction of the pedals, increasing load and, consequently, the force imposed⁶. This alteration in the pedaling position associated with gravitational force could effectively help in the propulsion phase, that is, the mass of the cyclist is propelled favorably against the pedals, assisting in the torque generation¹², besides the anthropometric characteristics, poor balance, and coordination¹⁴.

Duc et al.¹⁹ investigating different slopes in standing and seated positions in an incremental test demonstrated that a change from the seated position to standing affected the intensity and time of electromyography activation of the lower limb and, mainly, arm and trunk muscles. A study conducted by Li and Caldwell¹³ reported that cyclists in the standing position produced greater electromyography activity in monoarticular muscles, gluteus maximus, and vastus lateralis when compared with biarticular straight muscles and femoral biceps, which could translate into a reduction in fatigue of the biarticular muscles and selective fatigue of the monoarticular muscles during cycling while standing. In this way, we can infer that the same movement can generate different levels of fatigue in distinct muscle groups. Furthermore, the level of training can influence the test results, causing divergence in the data in the literature.

In the FI relationship, no significant differences were found between positions, which corroborates the results of Reiser et al.⁶, however, studies have used the FI as an index to indicate the capacity of athletes to maintain anaerobic performance and, possibly, not suffer the effects of fatigue²¹. In cycling, fatigue has been related to a reduction in pedaling technique and quantified through changes in the standards of muscular electrical activation²², which may explain the results of the present study. However, to verify this affirmation it is necessary to quantify peripheral fatigue across specific and more reliable techniques. The PHR did not present statistical differences⁷, indicating that the athletes performed both tests at maximum effort.

Lastly, studies that utilized the same approach present methodological inconsistencies in the realization of

the protocol⁷, for example, the type of warm-up preceding the test can cause interference in the validity of information obtained. Another situation found that can directly affect data is the WT resistance adopted for each test and the sample of the studies. For example, Reiser et al.⁶ used resistance of 8.5% of body mass in university cyclists, while Mclester et al.¹ and Wilson et al.⁷ used 7.5% of body mass of active college students and professional ice speed skating athletes, respectively. Even so, the protocols should consider the principal variable investigate since different resistance applied may offer differences in power peak²³ and other strategies²⁴. More specifically, the authors argued that to quantify the maximal power, different resistances are recommended in different trials to identify higher power output²⁰. Thus, the specificity of the test can interfere with the results, as well as the learning effect¹.

The principal's limitations of the study were the size of the sample, just like not-realization of familiarization session, nevertheless, exists a specificity between training types performed by athletes with WT. In relationship with the practical applications, the evaluation sprints positions reflect the reality of cycling, in addition, it enables the knowledge of power values comparable with performance in races, training, and tests.

Conclusions

The results found this study confirm that, the performance obtained was better in the WT realized in the standing position when compared with the seated position in competitive cyclists. We suggest that for anaerobic evaluation of cyclists, the WT performed in both positions could be a useful tool to establish the characteristics of power production between positions. This result also assists in the discussion of the importance and interference of the relationship of body mass with anaerobic power production capacity in the WT, which should be taken into account in future studies. Furthermore, we suggest the manipulation of the time in the standing position at the start of the test, in order to verify the optimal time to maintain this position before sitting, as well as performance in different positions on cycle ergometers with electromagnetic braking in professional cyclists.

Acknowledgments

This research received financial support from the Conselho Nacional de desenvolvimento Científico e Tecnológico (CNPq), Fundação Araucária and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

References

1 McLester JR, Green JM, Chouinard JL. Effects of standing vs. seated posture on repeated Wingate performance. *J*

- Strength Cond Res. 2004; 18(4):816-820. Doi: 10.1519/14073.1.
- 2 Baron R. Aerobic and anaerobic power characteristics of off-road cyclists. *Med Sci Sports Exerc.* 2001; 33(8):1387-1393. Doi: 10.1097/00005768-200108000-00022.
- 3 Faria EW, Parker DL, Faria IE. The Science of Cycling. *Sports Med.* 2005; 35(4):285-312. Doi: 10.2165/00007256-200535040-00002.
- 4 Sanderson DJ, Cavanagh PR. Use of augmented feedback for the modification of the pedaling mechanics of cyclists. *Can J Sports Sci.* 1990; 15(1):38-42. Doi: 10.1152/ajpregu.00668.2006.
- 5 Vandewalle H, Pérès G, Monod H. Standard Anaerobic Exercise Tests. *Sports Med.* 1987; 4(4):268-289. Doi: 10.2165/00007256-198704040-00004.
- 6 Reiser R, Maines J, Eisenmann J, Wilkinson JG. Standing and seated Wingate protocols in human cycling. A comparison of standard parameters. *Eur J Appl Physiol.* 2002; 88(1-2):152-157. Doi: 10.1007/s00421-002-0694-1.
- 7 Wilson RW, Snyder AC, Dorman JC. Analysis of seated and standing triple Wingate tests. *J Strength Cond Res.* 2009; 23(3):868-873. Doi: 10.1519/JSC.0b013e31819d0932.
- 8 Arslan C. Relationship Between the 30-s Wingate Test and Characteristics of Isometric and Explosive Leg Strength in Young Subjects. *J Strength Cond Res.* 2005; 19(3):658. Doi: 10.1519/14533.1.
- 9 Coso J Del, Mora-Rodríguez R. Validity of cycling peak power as measured by a short-sprint test versus the Wingate anaerobic test. *Appl Physiol Nutr Metab.* 2006; 31(3):186-189. Doi: 10.1139/h05-026.
- 10 Jackson AS, Pollock ML. Practical Assessment of Body Composition. *Phys Sportsmed.* 1985; 13(5):76-90. Doi: 10.1080/00913847.1985.11708790.
- 11 Inbar O, Bar-Or O, Skinner J. Wingate anaerobic test. Champaign, IL. Human Kinetics, 1996.
- 12 Stone C, Hull ML. Rider/Bicycle Interaction Loads during Standing Treadmill Cycling. *J Appl Biomech.* 1993; 9(3):202-218. Doi: 10.1123/jab.9.3.202.
- 13 Li L, Caldwell GE. Muscle coordination in cycling: the effect of surface incline and posture. *J Appl Physiol.* 1998; 85(3):927-934. Doi: 10.1152/jappl.1998.85.3.927.
- 14 Merkes PFJ, Menaspà P, Abbiss CR. Power output, cadence, and torque are similar between the forward standing and traditional sprint cycling positions. *Scand J Med Sci Sports.* 2019; (August):sms.13555. Doi: 10.1111/sms.13555.
- 15 Kim J, Cho HC, Jung HS, Yoon JD. Influence of Performance Level on Anaerobic Power and Body Composition in Elite Male Judoists. *J Strength Cond Res.* 2011; 25(5):1346-1354. Doi: 10.1519/JSC.0b013e3181d6d97c.
- 16 Tricoli VAA, Barbanti VJ, Shinzato GT. Muscle power in basketball and volleyball players: the relationship between isokinetic dynamometry and vertical jump. *Rev Paul Educ Física.* 1994; 8(2):14. Doi: 10.11606/issn.2594-5904.rpef.1994.138428.
- 17 Soden PD, Adeyefa BA. Forces applied to a bicycle during normal cycling. *J Biomech.* 1979; 12(7):527-541. Doi: 10.1016/0021-9290(79)90041-1.
- 18 Neptune RR, Hull ML. Methods for Determining Hip Movement in Seated Cycling and Their Effect on Kinematics and

- Kinetics. *J Appl Biomech.* 1996; 12(4):493-507. Doi: 10.1123/jab.12.4.493.
- 19 Duc S, Bertucci W, Pernin JN, Grappe F. Muscular activity during uphill cycling: Effect of the slope, posture, hand grip position, and constrained bicycle lateral sways. *J Electromyogr Kinesiol.* 2008; 18(1):116-127. Doi: 10.1016/j.jelekin.2006.09.007.
- 20 Costes A, Turpin NA, Villeger D, Moretto P, Watier B. Spontaneous change from seated to standing cycling position with increasing power is associated with a minimization of cost functions. *J Sports Sci.* 2018; 36(8):907-913. Doi: 10.1080/02640414.2017.1346272.
- 21 Zacharogiannis E, Paradisis G, Tziortzis S. An Evaluation of Tests of Anaerobic Power and Capacity. *Med Sci Sports Exerc.* 2004; 36(Supplement): S116. Doi: 10.1097/00005768-200405001-00549.
- 22 Diefenthaler F, Vaz MA. Aspectos relacionados à fadiga durante o ciclismo: uma abordagem biomecânica. *Rev Bras Med Do Esporte.* 2008; 14(5):472-477. Doi: 10.1590/S1517-86922008000500014.
- 23 Jaafar H, Rouis M, Coudrat L, Attiogbe E, Vandewalle H, Driss T. Effects of Load on Wingate Test Performances and Reliability. *J Strength Cond Res.* 2014; 28(12):3462-3468. Doi: 10.1519/JSC.0000000000000575.
- 24 Glaister M, Muniz-Pumares D, Patterson SD, Foley P, McInnes G. Caffeine supplementation, and peak anaerobic power output. *Eur J Sports Sci.* 2015; 15(5):400-406. Doi: 10.1080/17461391.2014.962619.

Corresponding author

Fernando de Souza Campos Centro de Desportos da Universidade Federal de Santa Catarina, Campus Reitor João David Ferreira Lima, Trindade, 88040-900, Florianópolis, SC, Brasil.
E-mail: campos.mn@hotmail.com.

Manuscript received on September 16, 2019

Manuscript accepted on April 1, 2020



Motriz. The Journal of Physical Education. UNESP. Rio Claro, SP, Brazil
- eISSN: 1980-6574 – under a license Creative Commons - Version 4.0