EFFECTS OF DIFFERENT GOAL ORIENTATIONS AND VIRTUAL OPPONENTS PERFORMANCE LEVEL ON PACING STRATEGY AND PERFORMANCE IN CYCLING TIME TRIALS

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Original Investigation

ABSTRACT

We investigated the effects of different performance goals (best time *vs.* beat the opponent) on pacing behaviour during a 10-km cycling race and explored the influence of different performance level of opponents on ratings of perceived exertion (RPE), affective feelings and self-efficacy. Thirteen cyclists performed two time-trials (TT) and two races against a faster (FAST +6%) or a slower (SLOW –3%) virtual opponent. Power output (PO), RPE, affective feelings and self-efficacy were recorded at each kilometer point. Race average and race phases [starting (P1= first kilometer); first half (P2=2nd to 5th km); second half (P3=6th to 9th km) and final sprint (FS=last kilometer)] were analyzed. There was no difference in performance, assessed by race time between conditions (p=0.84). PO during TT was lower in P3 compared to FS (p=0.03; ES 0.6; 90%CI 0.4 to 0.7). In SLOW and FAST, PO was higher in P1 compared to other phases (p<0.05). PO in FS was higher in TT compared to FAST (p=0.01; ES -0.97; 90%IC -1.4 to -0.5). RPE increased and affective feelings decreased during all conditions. Self-efficacy was stable through TT and SLOW, but decreased during FAST with higher values in P1 compared to P2 (p=0.01; ES -1.1; 90%IC -1.6 to -0.6), P3 (p<0.001; ES -2.2; 90%IC -2.8 to -1.6) and FS (p<0.001; ES -2.6; 90%IC -3.3 to -1.8). Pacing behaviour, specifically starting and final sprint, was affected by virtual opponents independent of performance level, demonstrating the importance of goal orientation.

Keywords: cycling, performance, pacing, self-efficacy, affect

INTRODUCTION

Pacing represents an athlete's regulation of intensity during an exercise bout and is an important determinant of athletic performance (1,2). Adjustments in exercise intensity result from a complex decision-making process involving physiological, psychological, environmental and tactical information (3,4). In this process, athlete's experience, associated with knowledge about the race distance are important for pacing adjustments (5,6).

Given that during many endurance competitions athletes regulate exercise intensity with the aim of achieving the fastest performance time possible, the pacing displayed likely depends on the athlete's goal setting (7,8). Goal pursuit is an important determinant of pacing behaviour since athletes must balance their efforts with expectations of success (8). In a fixed distance time-trial (TT) event where the goal is to achieve the best time possible and there is no other competitor influencing performance, exercise intensity is continually adjusted based on athlete's perception of effort and the remaining distance. However, in a race against real or virtual opponents, where the goal is to win the race or finish in as high a position as possible regardless of finishing time, there may be a change from an internal to an external focus in an athlete-opponent interdependency (9), adding a layer of complexity to the decision-making process (4,10).

Both ratings of perceived exertion (RPE) and affective feelings have been implicated in the regulation of pacing (7,11,12). During an exercise bout, intensity is adjusted to ensure RPE reaches maximal values only towards the end of the bout and that the rate of increase in RPE is related to the exercise duration (13). An increase in RPE is typically associated with a decrease in affective feelings (11). Affective feelings are also influenced by athlete's self-efficacy (14,15), which represents the perception of success in relation to goals and expectations (16). Therefore, a higher self-efficacy during exercise could dissociate affective feelings from RPE and consequently influence athlete's decision-making regarding exercise intensity, and ultimately pacing behaviour (7,17). As a result, increasing self-efficacy could maintain higher affective feelings and, to some extent, enhance exercise performance relative to opponents. Conversely, the perception of failure could reduce self-efficacy, inducing more negative affective feelings and consequently the amount of effort one is willing to exert (18). Although the effects of opponents on performance and pacing has been demonstrated (19-22), the influence of self-efficacy and affective feelings is not well understood.

Do Carmo et al. (19) showed that affective feelings were higher in a head-to-head (HTH) running race than in an individual TT, even though RPE was similar and average exercise intensity was higher. Additionally, athletes that failed to finish the HTH race reported similar RPE to during the TT, despite experiencing more negative affective feelings. The authors suggested that affective feelings could explain the better performances or failure to finish a HTH race, and may be associated with the athlete's perception of progress towards a goal. However, this was only an observational study whereby affective feelings were not manipulated, and self-efficacy was not assessed. Jones et al. (23) observed important interaction between RPE and affective feelings during 16.1 km and 40 km cycling TT's. Self-efficacy was not different between TT's and did not seem to influence results. However, goal orientation remained the same (achieve the best time possible) regardless of trial distance. Williams et al. (21) investigated the influence of the presence of virtual faster and slower opponents during a simulated 16.1 km cycling race. They observed faster or slower starts depending on opponents' behaviour, albeit with no overall performance differences. The authors observed lower self-efficacy in the faster opponent condition, however, the avatar only remained visible for the first 4 km, and any influence over the entire course, especially the final stages, was not assessed.

Williams et al. (22) reported that performance during a 16.1 km cycling TT was higher in three deception conditions (2%, 5% faster or both opponents) compared to a control condition. Participants indicated self-efficacy against two goal orientations: maintaining pace or competing with the opponent. Performance improvement and more positive affective feelings observed in the 5% condition may be related to the goal orientation to maintain the pace. In the 2% condition, higher self-efficacy and better performance may be associated to the goal orientation to compete with the opponent but not necessarily to beat the opponent. The duality in the goal orientation may have allowed the athlete to change the focus according to the most likely outcome. Therefore, the influence of self-efficacy on performance and pacing behaviour against a specific goal orientation needs to be better elucidated. In addition, only deception conditions were manipulated and the different responses in decision making are not known when conditions of likely success or failure are compared.

Our primary aim was to investigate the effects of different goals orientations during a 10 km TT and an HTH cycling race on RPE, affective feelings, self-efficacy and pacing behaviour. Our second aim was to describe the influence of the presence of faster or slower virtual opponents on these variables. Given that self-efficacy is directly influenced by athlete's goal setting, and it has an indirect influence on pacing behaviour, we hypothesized that pacing behaviour will differ between a TT, when the goal is to achieve the best time, and a HTH race, when the goal is to beat opponents. Furthermore, the presence of opponents with different performance abilities will influence self-efficacy and possibly affective feelings and pacing behaviour.

MATERIALS AND METHODS

Participants

Thirteen recreational male cyclists (37.5 ± 7.6 yr; 1.76 ± 0.04 m; 76.4 ± 7.0 kg; peak power 311.9 ± 46 W and relative peak power 4.1 ± 0.7 W/kg) volunteered for the study. Participants were classified as being of level 2 performance - recreationally trained (24). As inclusion criteria, the participants needed to have at least 24 months of competitive cycling experience, to train more than 3 times and 5 hours/week and cover more than 60 km per week. They were not eligible if they have ingested any illegal performance enhancing substance in the previous six months or had any health problems that could place them at risk or influence the study results. Before the study, all participants completed a PAR-Q questionnaire and a medical exam clearing them to perform high intensity exercise. Participants provided written informed consent, and the study was approved by the institutional research ethics committee. Power analysis (G-Power; v. 3.1.9.2, University of Kiel, Germany) indicated that a sample size of 13 participants achieved 85% power with a 5% significance level and an expected effect size of 0.4.

Experimental design

A cross-over design was used to investigate power output (PO), affective feelings, self-efficacy and RPE in a 10-km cycling TT and a race against virtual opponents of different performance levels. Participants visited the laboratory on five days 48 – 72h apart and at the same time of the day (±1h). Tests were conducted in a controlled environment with room temperature between 18-21ºC and a fan was positioned laterally to the cyclist. Participants were asked to refrain from strenuous exercise, alcohol, caffeine, or other stimulant consumption 24h prior to the tests, and to maintain normal dietary practices and training routines throughout the testing period.

In the first visit, the anthropometric measures (body mass and height) were taken and a maximal incremental test was performed. Participants were familiarized with the experimental procedures, including the virtual circuit, the 6-20 RPE scale (25) and feeling scales (26). In the second and third sessions the 10-km TT (TT1 and TT2) was performed to estimate test-retest reproducibility. For TT1 and TT2, participants were instructed to complete the trials as fast as possible. The best TT performance was used for statistical analysis and to determine the virtual opponent's performance. The fourth and fifth sessions were performed in a randomized order, each consisting of an HTH 10-km cycling with a faster (FAST) or slower opponent (SLOW) based on the participant's best TT performance and participants were instructed to attempt to beat their opponent. Additionally, to encourage greater competitiveness among the participants, they were led to believe that they were competing against other participants in the study. Throughout the races, PO was continuously recorded and RPE, affective feelings and self-efficacy were recorded every 1 km.

Maximal incremental test

Maximal incremental test was performed on the participants' own bicycle attached to a cycle simulator (I-Genius, Tacx, Netherlands). After an eight-minute warm-up (six minutes at self-selected PO and cadence and two minutes at 100 W and 80 to 90 rpm), the test started at 50 W, with 20 W increments every 2 minutes until exhaustion. The cadence (80 to 90 rpm) and gearing were sustained throughout the test. The test stopped once the participant could not maintain the cadence or until volitional exhaustion. The highest mean PO achieved during any 30 s average as considered as the participant's peak PO. Heart rate (HR) was recorded continuously during the test (Polar, RS800CX, Kempele, Finland) and maximum heart rate (HR_{max}) was determined as the highest value obtained at the end of the test.

10-km cycling races

The races were performed in a 250 m virtual velodrome and the 10 km distance was chosen to represent the distance used during qualifying rounds in scratch races. The races were performed on the participant's own bicycle attached to a cycle simulator (I-

Genius, Tacx, Netherlands) interfaced with a software. The three-dimensional velodrome was project on a wide screen 170 cm in height and 302 cm in width positioned 3 m from front wheel. Participants self-selected their exercise intensity and were provided with information regarding distance, speed and PO. During the races against virtual opponents, they followed their position during the entire race, visualized the virtual opponent, or through a small image with the overview of the circuit in the upper corner of the screen.

Virtual opponents had their route and power adjusted based on participant's best TT. In the faster opponent condition (FAST), the virtual opponent adopted the same pacing but with performance adjusted to be 6% faster. Similarly, in the slower opponent condition (SLOW), virtual opponent's performance was set at 3% slower. These intensities were determined based on a pilot study by the laboratory to attain a condition in which the participant still believed they could win the race or otherwise in the first half of the race.

Affective feelings, RPE and self-efficacy were measured every 1 km. Affective feelings were measured using the feeling scale (26). Ratings of perceived exertion was assessed using Borg's 6-20 scale (25). Task-specific self-efficacy was determined using a five-item scale (23). Participants were asked to rate their level of confidence in achieve their goal on a percentage scale from 0% (cannot do at all) to 100% (certainly can do). During the TT, they were asked if they believed that could achieve their best time, and in both race conditions if they believed they could beat their opponent.

Statistical analysis

After assuring data normality with the Shapiro-Wilk test, data are presented as mean and standard deviation (SD). A paired t-test was performed to compare race time between TT1 and TT2. The intraclass correlation coefficient (ICC) and typical error (TE) were used to assess the reproducibility of performance and pacing strategy between both TTs conditions. For power output, RPE, affective feeling and self-efficacy analyses the races were divided into four phases: Starting phase (P1): first 1 kilometer; first half of race (P2): 2nd to 5th km; second half of race (P3): 6th to 9th km; final sprint (FS): last kilometer. Only the faster of the two TTs (TT1 and TT2) was included in the inferential analysis. Comparison of race time between conditions (TT, FAST and SLOW) was performed using one-way repeated measures ANOVA. Variables in different race phases were analysed using two-way repeated measures ANOVA with condition and race phase as factors. When a significant F value was found, a Tukey post hoc was used for multiple comparison purposes. The significance level was set at $p<0.05$. The effect size between-conditions was calculated and interpreted by using values of 0.2, 0.6, 1.2, 2.0 and 4.0 as thresholds for small, moderate, large, very large and extremely large, respectively. The 90% of effect size confidence interval (CI90%) were calculated for all dependent variables and considered as unclear when they included zero. Statistical analyses were conducted using SPSS 22.0 (IBM, Chicago, IL).

RESULTS

The race completion time and mean PO were highly reproducible between the two TT's. We also observed high PO reproducibility in the four race phases. Although we did not observe significant difference in FS, the TE was higher and ICC was lower compared to other phases. Nine out of 13 participants performed better in TT2. Race completion time mean PO and PO by race phase in both TT1 and TT2 are displayed in Table 1.

Insert Table 1

There was no difference in performance, assessed by race time between the three conditions (F=0.182; p=0.84). There were also no differences in PO average values (F=0.259; p=0.77), cadence (F=0.408; p=0.67), heart rate (F=0.826; p=0.44), RPE (F=0.001; p=0.99) and affective feelings (F=1.6; p=0.21) between TT, SLOW and FAST (Table 2). However, we observed between-condition differences in self-efficacy, which was higher in TT (p=0.001; ES 1.7; 90%CI 1.3 to 2.2) and in SLOW (p<0.000; ES 1.8; 90%CI 1.1 to 2.6) when compared to FAST, with no difference between SLOW and TT. Virtual opponent's performance was designed to elicit failure and success of the participants in the FAST and SLOW. As expected, every participant won and lost the races in SLOW and in FAST, respectively.

Insert Table 2

Figure 1 displays PO in different phases of the races. It was similar in P1, P2 and P3 during TT (p>0.05) but was lower in P3 compared to FS (p=0.03; ES 0.6; 90%CI 0.4 to 0.7). In SLOW, PO was higher in P1 compared to other race phases (P2, p =0.05; ES=-0.7; 90%IC -1.03 to -0.45; P3, p=0.001; ES -1.01; 90%IC -1.4 to -0.5; FS, p=0.01; ES -0.8; 90%IC -1.2 to -0.4). Similarly, a fast start pacing behaviour was observed in FAST. In other words, PO was higher in P1 than P2 (p=0.003; ES -0.9; 90%IC -1.3 to -0.5), P3 (p=0.001; ES -1.3; 90%IC -1.8 to -0.8) and FS (p=0.02; ES -1.1; 9%IC -1.7 to -0.6). Between-condition comparisons indicated differences only in FS, where PO was higher in TT compared to FAST (p=0.01; ES -0.97; 90%IC -1.4 to -0.5; Figure 1A).

RPE increased from P1 to P2 and P3 ($p<0.05$) during all race conditions, but there was no difference between P3 and FS. Ratings of perceived exertion were similar between TT, SLOW and FAST ($p>0.05$, Figure 1B). Affective feelings became more negative during all conditions. During TT, affective feelings were higher in P1 compared to P3 and FS (p=0.004; ES -0.9; 90%IC -1.4 to -0.5 and p=0.001; ES -1.2; 90%IC -1.9 to -0.4, respectively). Likewise, affective feelings were higher in P2 compared to FS, with an unclear effect size (p =0.04; ES -0.6; 90%IC -1.3 to 0.1). Similar behaviour was observed in both SLOW and FAST where affective feelings were higher in P1 than in P3 (SLOW, p=0.03; ES -0.7; 90%IC -1.1 to -0.3; FAST, p=0.006; ES -1.01; 90%IC -1.7 to -0.3) and in FS (SLOW, p=0.03; ES -0.7; 90%IC -1.2 to - 0.2; FAST, p=0.002; ES -1.1; 90%IC -1.8 to -0.4). No differences were observed between conditions ($p>0.05$, Figure 1C).

Self-efficacy did not change throughout TT and SLOW ($p>0.05$). However, in FAST, self-efficacy decreased during the race with higher values observed in P1 compared to P2, P3 and FS (p=0.01; ES -1.1; 90%IC -1.6 to -0.6; $p<0.001$; ES -2.2; 90%IC -2.8 to -1.6 and $p<0.001$; ES -2.6; 90%IC -3.3 to -1.8, respectively). Additionally, self-efficacy was higher in P2 than P3 and FS (p=0.01; ES -1.1; 90%IC -1.5 to -0.6 and p=0.001; ES -1.4; 90%IC -2.4 to -0.5). Between-condition comparisons indicated no differences in P1, but lower values in FAST compared to both TT and SLOW in P2 (TT, p=0.01; ES 0.8; 90%IC 0.5 to 1.1; SLOW, p=0.006; ES 0.9; 90%IC 0.3 to 1.6), P3 (TT, $p<0.001$; ES 1.5; 90%IC 1.1 to 1.9; SLOW, $p<0.001$; ES 1.6; 90%IC 2.3 to 0.7) and FS (TT, $p<0.001$; ES 1.7; 90%IC 1.2 to 2.2; SLOW, $p<0.001$; ES 1.7; 90%IC 1.1 to 2.3; Figure 1D).

******Insert Figure 1******

DISCUSSION

The aim of this study was to investigate the effects of different goal orientations, on pacing behaviour and performance during 10-km cycling. We also observed the effects of competition against a slower or faster opponent on pacing behaviour, RPE, affective feelings and self-efficacy. Our results show that although the presence of virtual opponents did not affect performance, it influenced pacing behaviour. During TT, participants were more conservative in the initial phase of the race with an increase in PO during the final sprint. In contrast, when competing against virtual opponents they performed a fast-start, but PO was not increased during final sprint. We suggested that changes in pacing behaviour seem to be related to goal orientation since no differences were observed in RPE and affective feelings between the conditions, and the lower self-efficacy observed in FAST appears to have little influence on pacing behaviour.

The lack of change in performance with different goal orientations is contrary to our expectations given that the performance improvement with the presence of opponents has been well documented (19,20,22). Konings et al. (20) reported improved 4-km cycling performance when racing against a virtual opponent with performance set as the participants' best familiarization performance. Similarly, Williams et al. (22) observed performance improvements even when athletes competed against opponents 2% and 5% faster in a 16.1-km cycling TT. However, we set virtual opponent's performance at either 3% slower or 6% faster than participant's best TT. Given we asked participants to attempt to beat their opponents, they were able to defeat the SLOW opponent without improving their performance. In fact, the SLOW condition performance was only 4 seconds (0.12%) slower than the TT performance. Therefore, after the fast start participants maintained effort, without the need for a final-sprint to reach their goal and beat their opponent with a margin of ~45 sec. Conversely, during FAST individuals were far behind the avatar by P2, eventually losing the race by ~ 42 seconds. Based on the observed decrease in self-efficacy, we therefore suggest motivation for continued goal pursuit was negatively impacted. Similar results were reported by Williams et al. (21) whereby the presence of faster or slower opponents did not change performance time in a 16.1 km cycling race. Although no changes in performance time were observed, in both studies pacing behaviour was influenced by the level of performance of the opponents.

During P1 in both SLOW and FAST, power output was higher compared to the other phases of the race and to the same phase in TT. Fast-start strategies are observed in races against opponents (20) and this finding is in accordance with the suggestion by Williams et al. (21) that when racing against opponents a higher power output was observed at the start of the race in an attempt to defeat the adversaries. These higher intensities at the beginning of race seem to be induced by motivational aspects (27).

Conversely, the final sprint was observed only during TT. These findings corroborate with previous studies and indicate that in TT, athletes increase power output in the final part of the race when they realize they can sustain higher power outputs without premature fatigue in an attempt to improve performance (1,28,29). However, we demonstrated that the ability to produce a final sprint is related not only to perceptions of fatigue, but also to goal orientation. In the final part of the race against opponents, participants were either far ahead or far behind their avatars in the SLOW and FAST conditions, respectively. Considering that we asked participants to attempt to defeat their opponents, and not to produce their best time possible, the distance between participants and avatars reduced self-efficacy, and probably motivation in FAST, and might explain why participants did not increase power output in FS. Alternatively, in SLOW at the end of the race, the participant had already to some extent achieved their goal, without the need for a final sprint. Therefore, the presence of the virtual opponent and the goal orientation affected pacing behaviour in the initial and in the final part of the race, but not during P2 and P3.

Ratings of perceived exertion increased during the race, with no differences between conditions. As in other studies, RPE increased progressively and reached their highest values close to the end of exercise (20,21,23). We did not observe any changes in the progression of RPE between TT and SLOW or FAST, even though power output differed in the early and the late phases of the race. This suggests that RPE was directly related to race distance and influenced not only by required effort, but also by psychological factors, such as affective feelings and perceptions of self-efficacy given that the PO differed with the same RPE in different conditions.

Affective feelings decreased from P1 to P3 and to FS in all conditions. This was expected as affective feelings and RPE (14) are inversely related and we observed a progressive RPE increase throughout exercise. In addition, affective feelings might also be related to self-efficacy, as the former is higher when individuals believe that they can achieve their goal (i.e., high self-efficacy) (14). During TT, self-efficacy was high while affective feelings were declining, but that might be explained by the lack of an opponent and a more stimulating goal. During FAST, self-efficacy declined over the course of exercise as also happened with affective feelings. However, in SLOW, self-efficacy was high throughout, and affective feelings declined up to the 9^{th} km before increasing in the final stages, which may be related to increased certainty regarding goal achievement.

Therefore, in this study, self-efficacy was the only variable altered by the presence of a faster opponent. The affective feelings are dissociated from RPE only when participants realize they have been successful in relation to goal achievement.

This study has some limitations that should be considered. We investigated the effects of virtual opponents in a controlled environment, which could be different from what is observed in a real situation where the decision making can be driven by tactical considerations. Another limitation is related to the participants performance level, who despite the competitive and training years' experience may make decisions differently than high performance participants due to physiological and tactical characteristics. Virtual opponent's intensities were defined based on pilot studies where 3% slower was an intensity that allowed participants to win while maintaining competitiveness during the race. In the 6% faster condition, we expected that in addition to participants losing, they would perceive their impending loss sooner in the race, and we would be able to observe changes in pacing behaviour and its relationship with self-efficacy and affective feelings. However, it is possible that intensities are either too slow or too fast and the participant realized this early in the race, thereby changing their motivation. Another possibility is that participants changed their goal orientation during the race. However, self-efficacy was measured each kilometer and participants were specifically asked about success or failure related to their goal orientation on that day (best performance possible and beat the opponent), thus, we believe this change in goal orientation was unlikely during the race since they were constantly reminded of it.

In practical terms, the presence of virtual opponents did not affect performance, despite previous suggestions of performance-enhancing effects of virtual opponents (20,22). Also, participants reported more positive affective feelings and self-efficacy when racing a slower opponent. This suggests that the presence of virtual opponents alone is not sufficient to motivate participants, and a more competitive environment may be included to motivate participants to maintain their effort and at the same time to improve their self-confidence.

Additionally, affective feelings seem to be dissociated from RPE when participants realize that they will be able to reach their goal. In fact, during a self-paced competitive endurance event, positive and negative affect, afferent physiological information, motivation, and goal setting play a role in this decision-making process (4). The perception of success in achieving a goal leads to positive affect while perception of failure could lead to negative affect, changing the risk-benefit relationship in decision making process and consequently participants will reduce the intensity or even give up the race (19,30). Therefore, inserting goal settings (challenging but achievable) throughout the race or training sessions could promote this dissociation, leading to a higher power output production. Further studies should be developed to verify the relationship between the small goal settings during the race in relation to affective feelings and power output.

CONCLUSION

Overall performance was not changed by the presence of virtual opponents. However, pacing behaviour was affected by the presence of virtual opponents independent of their performance level. When competing in a TT the participants performed a conservative initial phase with a more pronounced final sprint. Alternatively, in the presence of virtual opponents they displayed a fast-start strategy, without the presence of a final sprint. This study added to previous knowledge that the presence of a final sprint seems to be related to the goal orientation and perceived outcomes of success or failure. In addition, the RPE and affective feelings do not seem to change in the presence of virtual opponents or in relation to self-efficacy changes during the race. The lower self-efficacy observed in the presence of a faster opponent is possibly related to the perception of failure to achieve the goal of beating an opponent. However, it seems to not have a direct influence on overall performance or pacing behaviour.

The authors declare no conflict of interest.

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Table 1. Race completion time, mean PO and PO by race phase in both TT1 and TT2.

	TT1	TT2	p	ES (90%CI)	TE	ICC
Time (min:sec)	13:22 ± 00:47	13:11 ± 00:35	0.15	-0.2 (-0.4;0.03)	00:19	0.81
PO (W)	272.7 ± 39.2	277.3 ± 35.4	0.51	0.12 (-0.5;0.8)	17.2	0.82
P1 (W)	299.7 ± 77.6	305.9 ± 62.2	0.64	0.09 (-0.5;0.8)	33.2	0.81
P2 (W)	272.2 ± 44.9	275.1 ± 42.1	0.74	0.07 (-0,2;0.4)	23.1	0.75
P3 (W)	261.4 ± 33.8	266.7 ± 33.1	0.58	0.16 (-0.2;0.5)	20.9	0.65
FS (W)	293.1 ± 51.9	299.5 ± 37	0.7	0.14 (-.5;0.8)	40.6	0.2

TT – time-trial; ES – effect size; 90%IC – 90% of confidence interval, TE – typical error, ICC – intraclass coefficient correlation, PO – power output, P1 – Starting phase: first 1,000 m; P2 - first half of race : 2nd to 5th km; P3 - second half of race: 6th to 9th km; FS - final sprint: last kilometer.

Table 2. Mean values for conditions TT, SLOW and FAST.

	TT	SLOW	FAST
Completion time (min:sec)	13:05 ± 00:40 (12:41- 13:29)	13:01 ± 00:44 (12:34 – 13:27)	13:11 ± 00:47 (12:42 – 13:39)
PO (W)	284.3 ± 37.3 (261 – 306)	277.9 ± 42.7 (252 – 303)	272.5 ± 45.3 (245 – 299)
Cadence (RPM)	108.4 ± 8.6 (103 – 113)	109.4 ± 10.2 (103 – 115)	105.9 ± 11.6 (98 – 112)
Heart rate (bpm)	174 ± 4 (171 – 176)	169 ± 3 (167 – 170)	172 ± 5 (169 – 174)
RPE (AU)	14.58 ± 2.1 (13 – 16)	14.61 ± 2.4 (13 – 16)	14.57 ± 2.1 (13 – 16)
AF (AU)	1.2 ± 1.3 (0.4 – 2.1)	2 ± 2.04 (0.7 – 3.2)	0.7 ± 1.8 (-0.3 – 1.8)
Self-efficacy (%)	82.6 ± 18.1* (71 – 93)	84.6 ± 18.5* (73 – 95)	50.6 ± 22.4 (37 – 64)

Mean ± standard deviation (95% confidence interval), TT - time trial, SLOW – slower opponent, FAST – faster opponent; PO – power output, RPE – ratings of perceived exertion, AF – affective feelings. * $p < 0.05$ compared to FAST

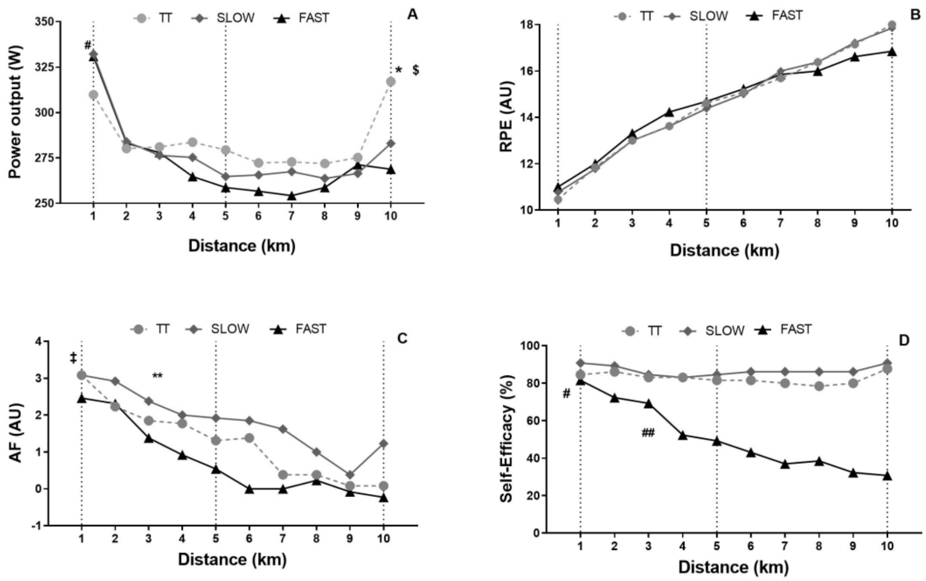

FIGURE 1. Power output, RPE, affective feelings and self-efficacy during TT, SLOW and FAST conditions. Dotted line represents the race phases divisions (P1, P2, P3 and FS). # $p < 0.05$ comparing P1 to P2, P3 and FS in SLOW and FAST conditions; significant differences ($p < 0.05$): * comparing FS to P3 in TT condition; $ in FS comparing TT to FAST; ‡ comparing P1 to P3 and FS in TT, SLOW and FAST; ** in TT comparing P2 to FS; ## in FAST comparing P2 to P3 and FS. Error bars removed for clarity.

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