Journal of Strength and Conditioning Research Publish Ahead of Print
DOI: 10.1519/JSC.0000000000002364

Race profiles of rowers during the 2014 Youth Olympic Games

Cerasola D[1], Cataldo A[2], Bellafiore M[2], Traina M.[2], Palma A[2], Bianco A[2], Capranica L.

[1]Department of Movement, Human and Health Sciences, University of Rome Foro Italico, Rome, Italy

[2] Sport and Exercise Sciences "DISMOT" Research Unit, University of Palermo

Abstract

Among the different factors affecting the outcome of élite rowing competitions pacing strategy plays a relevant role. The purpose of this study was to analyse the race profiles of youth athletes competing at the 2014 Youth Olympic Games over a distance of 1000-m.

*A*ccording to the competition outcome of sculling and sweep events, 96 youth (17-18 years) rowers (48 male and 48 female) were divided in winner (W), not winner (NW), qualified (Q) and not qualified (NQ) athletes. Time during the 1000-m race distance was considered at 0-500m (T1) and 500-1000m (T2). The average speed for T1 and T2 were normalized in relation to the average speed of the whole race. In both sexes, W rowers showed higher ($p>0.05$) T2 values (100.8±0.9%) with respect to T1 (99.2±0.9%) ones. Female athletes showed a higher ($p<0.05$) T1 with respect to T2 in NW, Q and NQ, whereas male athletes exhibited a higher T1 ($p<0.05$) than T2 speed only in NQ. Whilst to be admitted to the final phase of the competition the rowers tended to favour a positive race strategy (88%), during the final phase a difference ($p=0.43$) emerged for outcome, with the majority of medallists (67%) adopting a negative race strategy. These results suggest that winners have applied a different race strategy compared with the other groups in consequence to a higher efficiency of anaerobic metabolism.

Introduction

In 1900 men's rowing was included in the Summer Olympic Games, with women's events introduced in 1976. Furthermore, since 2010 men's and women's rowing events are also included in the Youth Olympic Games. The Fédération Internationale des Sociétés d'Aviron (FISA), rules the International rowing events at senior and youth levels, encompassing sculling and sweep rowing competitions (10). Whilst sculling rowing requires athletes to use two oars pulled simultaneously, athletes engaging in sweep rowing use only one oar. In particular, sweep-rowing competitions could include a cox to help rowers maintaining the boat in a proper direction and informing about the tactic of the race. In general, FISA recognizes 3 boat classes for sculling (i.e., Single 1x; Double 2x; Quadruple 4x) and 5 boat classes for sweep rowing (i.e., Pair 2-; Coxed Pair, 2+; Four, 4-; Coxed Four 4+; and Eight; 8+), with International events varying for the number and boat class competitions (10). In particular, for youth competition distances shorter than 2000m are organized (21). During the Naijing 2014 Youth Olympic Games 4 events were organized over a 1000m distance: 1) male junior single scull (i.e., 1xJm); 2) male junior two coxless (i.e., 2-Jm); 3) female junior single scull (i.e., 1xJf); 4), and female junior two coxless (i.e., 2-Jf). To assign the medals for the 1xJ events, 8 heats, 8 repêchages, 4 semifinals, and a final-A were organized, whereas the relative picture for the 2-J events included 4 heats, 4 repêchages and a final-A.

In the literature, information on the demands of this sport regards mainly the physiological responses to simulated senior 2000m competitions (8,27), fitness characteristics of elite (17) and youth (6,22) athletes. More recently, race patterns of official elite competitions have been investigated to highlight the athletes' management of effort regulation and specific tactics (4, 13,19,24). Indeed, being rowing a distance-based sport, the race strategy has a significant impact on the finishing position, which is often determined by marginal time differences between the medallists. The athlete's capability to administer tactically his/her energy resources throughout the race distance in relation to the opponents and environmental conditions is crucial to finish in the fastest possible time (14,28) and for winning or not-winning rowing outcomes (4,13).

Thus, information deriving from the analysis of race strategies during high-level competitions likely provides coaches and athletes more prior experience to better understand the race strategy and to regulate efforts in future competitions.

In general, taking into account the athlete's performance during intermediate 500m distances of a race, different types of race profiles could be observed (1,14,28): 1) "negative", when an increase in speed is observed; 2) "positive", when a decline in speed occurs; 3) "even", when the speed is maintained stable throughout the race; 4) "U shaped", when a powerful start is followed by declines in speed and a final increase in velocity during the last phase of the race. In rowing, race strategies may depend on the athletes' capabilities, experience, and/or on the tactics suggested by the trainer in relation to the opponents and the environmental conditions (4).

Surely, training adaptations (9,31) and rowing experience (4,14) contribute to the athlete's capability to maintain powerful phases during the rowing race and to adopt effective tactical strategies to preserve energies to perform the different phases of the rowing competition. In particular, successful elite female and male rowers participating in the 2000 Olympic Games, and in World Rowing Championships tended to adopt a positive (4,13,24), which could be attributed to the athletes' initial powerful phase with a successive slow down throughout the race, probably due to a variation towards the aerobic energy distribution (14) or to a deliberate tactical decision to preserve energies for later race segments to counteract eventual progresses of other competitors (24). Regardless the sex of the athletes, boat type, boat rank, and race phase (e.g., heats vs finals), a final spurt at the end the race was particularly observed during the 2008 Summer Olympic Games, especially evident in the last quarter during the final races when athletes attempt to win medals competing with the best rowing teams (24). Conversely, elite, national and sub-elite rowing competitive levels showed a similar effort management during intermediate sectors whereas fast starts characterized the elite level and marked end-spurts occurred at national-and sub-elite levels (4).

Despite International competitions for youth athletes are organized at local, regional, national and international levels, the lack of scientific information on race strategies of youth official races may affect the coaches' capability to plan proper strategies aimed at promoting the potential of talented athletes. Therefore, the aim of the present study was to compare the race strategies of young rowers during the 2014 Youth Olympic Games. It has been hypothesized that performance outcomes of youth men's and women's rowers competing in different boat classes might vary in relation to different race strategies throughout the different phases of the competition (e.g., heats, repêchages, semifinals and final-A races). This aspect is deemed particularly important because rowing competitions are elimination races, and competitors tend to save their best performance for the final race. Therefore, the present study could provide novel data to inform scholar and coaches on the athletes' management of efforts in relation to the competition phases.

Methods

Experimental design

This study considered the analysis of the race strategy of 1000m distance competitions during the Youth Olympic Games as a valuable research approach to investigate rowers' performance of talented athletes. According to the literature (4, 8), the official final and intermediate split times to cover 500m sectors (e.g., T1: 0-500m; and T2: 501-1000m) of the race were considered the experimental variable for performance. To allow comparison of race profiles T1 and T2 were normalized by calculating the average speed for each sector expressed as percentages of the average speed of the whole race. Although, it seems reasonable to hypothesize that the race dynamics are influenced by the environmental conditions during the different phases of the 2014 Youth Olympic Games, previous studies on elite rowing competitions do not consider this variable due to a lack of available official information. To participate in the Youth Olympic Games, athletes were selected mainly during the World Rowing Junior Championships, with additional five Continental Qualification Regattas (10).

Procedures

Archive data were collected from the official site of FISA (http://www.worldrowing.com). All official results reported in this Web domain were recorded for both male and female races. Ninety-six youth (17-18 years) rowers (48 males and 48 females) from 46 nations participated in the 2014 Youth Olympics Games. Overall, results of rowing on-water Competitions included 72 boats. Figure 1 shows a schematic representation of the competitive phases and the number of boats included in the study. The ranking of the boats and times over the first (T1) and last (T2) 500m of the race sectors were considered. Furthermore, the mean speed for was calculated T1 and T2 to provide insight useful for training. In fact, coaches consider speed as a training parameter when planning indoor rowing and on water training sessions.

Insert figure 1 here

Statistical analysis

Means and SDs were calculated for each of the analysed variables. Statistical significance was set at $p < 0.05$. Before using parametric statistical test procedures, the assumptions of normality and sphericity were verified. A 2 (sex: females vs males) x 2 (outcome: qualified vs not-qualified) ANOVA for repeated measures was applied to performances of 1xJ qualifying competitions. The performances to access the finals of the 1xJ (e.g., semifinalists) and 2-J (e.g., winners of the heats and repêchages) competitions were analysed by means of a 2 (sex: females vs males) x 2 (outcome: FB vs NFB) x 2 (boat: 1xJ vs 2-J) ANOVA for repeated measures. Finally, performances of the medalist (M) and not-medalist (NM) rowers during the semifinal and final competitions phases were compared by means of a 2 (sex: females vs males) x 2 (outcome: M vs NM) x 2 (boat: 1xJ vs 2-J) ANOVA for repeated measures. If the overall F test was significant, post hoc Fisher protected least significant difference comparisons with Bonferroni corrections were used. To provide meaningful analysis for significant comparisons from small groups, Cohen's effect sizes (ES) were also calculated, considering trivial ES <0.2, small ES=0.3–0.6, moderate ES=1.2, and large ES >1.2. Chi-square test was applied to positive and negative strategies for the qualifying, s and final phases of the competition.

Results

The 1xJ heats included 24 female and 24 male rowers, resulting in 8 female and 8 male qualified athletes for the semifinals (Q), whereas 20 female and 20 male athletes participated in the repêchages, which resulted in additional 8 female and 8 male Q rowers. Final-A 1xJ races included 6 female and 6 male rowers, resulting in 3 female M and 3 male NM athletes. The 2-J heats included 24 female and 24 male rowers, resulting in 4 female and 4 male Q athletes, whereas 20 female and 20 male athletes participated in the repêchages, which resulted in additional 8 female and 8 male Q athletes. Final-A 2-J races included 12 female and 12 male rowers, resulting in 6 M and 6 NM athletes for both sexes.

For the qualifying phase of the 1xJ races, a difference ($F_{(1, 44)}$=57.76, p<0.001; ES=0.75) emerged only between competition sectors, with higher values for T1 (101.9±1.7%) with respect to T2 (98.1±1.7%). Similarly, for the performances to access the finals phase of the 1xJ and 2-J, a difference ($F_{(1, 40)}$=31.8, p<0.001; ES=0.57) was found between competition sectors, with highest values for T1 (101.6±2.3%) and lowest for T2 (98.4±2.3%). Furthermore, a significant interaction ($F_{(1, 40)}$=10.9, p=0.002) was shown only between competition sectors x sex x outcome x boat (Fig. 2). However, post-hoc analysis with Bonferroni corrections did not confirm differences.

Insert figure 2 here

For the final phase of the 1xJ and 2-J competitions, no main effect was found. Significant interactions between competition sectors x outcome ($F_{(1, 16)}$=10.6, p=0.005) and between competition sectors x sex x outcome x boat ($F_{(1, 16)}$=4.9, p=0.041) emerged. When the performances of the medal winner (MW) and not-medallist (NM) rowers during the semifinal and final competitions were compared, a main effect was found only between race sectors $F_{(1, 16)}$=10.9, p=0.005,; ES=0.45). Furthermore, significant interactions emerged for sectors x outcome ($F_{(1, 16)}$=8.0, p=0.012), sectors x competition phase ($F_{(1, 16)}$=21.1, p<0.001), sectors x outcome x competition phase ($F_{(1, 16)}$=6.5, p=0.022), sectors x outcome x competition phase x sex ($F_{(1, 16)}$=4.6, p=0.047), sectors x competition phase x sex x boat ($F_{(1, 16)}$=14.5, p=0.002), and for sectors x competition phase x outcome x sex x boat ($F_{(1, 16)}$=6.0, p=0.026). Only the highest level of interactions was analysed further because it includes the lower level interactions (Fig. 3). Post-hoc analysis with Bonferroni corrections did not confirm differences.

Insert figure 3 here

Whilst to be admitted to the final phase of the competition the rowers tended to favour a positive race strategy (88%), during the final phase a difference (p=0.43) emerged for outcome with the majority of MW (67%) adopting a negative race strategy (Fig. 2).

Insert figure 4 here

Table 1 show the average speed ($m{\cdot}s^{-1}$) for T1 and T2 relative to the 1x and 2- female and male performances during qualifying and final phases of the competition. In the preliminary phases, the highest speed resulted always in T1, with Q athletes always showing higher values with respect to their NQ counterparts. In particular, NM maintained this trend also for the final phase. With the exception of male 1x athletes, M showed a higher speed with respect to NM in T1 with a further increase during T2.

Discussion

Due to the reduced distance of Youth Olympic Games (e.g., 1000m) with respect to elite competitions (e.g., 2000m), in the present study the race strategy of the athletes was evaluated only from the performances at the end of the first and second 500m segments. Independently from their sex, the present findings indicated that youth rowers accessing the Final-A of the Youth Olympics Games tend to decrease the speed of their boat throughout the race. Conversely, medal winners tend to increase the boat speed in the second phase of the race, despite a lack of statistical significance. To note, outstanding sport performances might not reach a statistical significance, yet maintaining a relevant athletic importance for achieving a medal.

To meet the ultimate goal to end the race with the fastest time, rowers have to rely on their physiological, psychological, technical and tactical capabilities in relation to environmental factors (18). At elite level, rowers tend to show stable physiological and performance characteristics overtime (29), and a similar and consistent rowing technique at all stroke rates (7). Furthermore, elite female and male rowers adopt a similar fast start strategy with a decrease in speed during the subsequent second and third sectors and a comparatively faster final sector (13,24). Whilst the literature on junior rowers reports a steady increase of physiological capabilities from maturation to elite status (19,22) and a certain variability of technical parameters with intensity of rowing (7), to our knowledge this is the first study that examined the race strategy in elite rowers participating in the Youth Olympic Games. Generally, also international youth rowing competitions are organized over a 2000m distance (e.g., Continental and World Junior Championships), whereas national competitions (21) and the Youth Olympic Games (10) encompass reduced distances (e.g., 1000m and 1500m). This reduction could be due to avoid that young athletes be exposed to an excessive psychophysiological strain (5,23). The present study could provide information on a series of useful indications to assist coaches in the optimization of rowing performances of their youth athletes.

In adults, the estimated energy contribution to accomplish the 2000m rowing race is 75% for the aerobic metabolism and 25% for the anaerobic ones (15), the latter being crucial during the initial phase (e.g., 40-60 s) of the race when the rowing stroke and the speed of the boat tend to be higher with respect to the remaining sectors, and during the last portion of the race when an increase in stroke rate and in boat velocity is observed for the final sprint (27). Therefore, it can be assumed that a distance of 1000m would require a somewhat larger anaerobic contribution, yet young athletes are known to rely more on an aerobic metabolism than is typically the case for adults (3,20,21,25). In other cyclic sports (e.g., running, cycling, speed skating), an optimal race strategy has to be settled in relation to the duration of the exercise bout (11), with a fast start followed by a progressive slowing being considered optimal for events lasting <110s (9,31), and an even pace supposed more beneficial during events of longer duration (16). In this study, the on-water 1000m races were accomplished within 190-240s, with different race strategies adopted in the heats and the Final-A of the competitions. Similar to elite athletes competing in races lasting 120–290s (12), during the heats and repêchages the youth athletes performed a fast start and decreased their speed during the last sector. It could be speculated that the high initial power output might have determined an initial metabolic acidosis, which may inhibit anaerobic glycolysis and muscle contraction and result in a decrease in maximal power output and capability to produce an effective technique (30). However, this phenomenon does not replicate during the Final-A, where medal winners were faster than their counterparts during the first sector and tended to increase their speed during the final sector of the race, strongly supported by the anaerobic metabolism (2). Therefore, the different race strategies adopted during the competition phases underline the capability of medal winners to adopt effective tactical decision and to save energy for the most important sector of the competition.

Another interesting finding is the lack of difference in the race strategy adopted by 1J and 2-J athletes. These findings are in line with the literature on the analysis of the race strategies during the Olympic Games and rowing world championships.

In fact, some authors (13,19,26) reported a fast speed during the first 500 m, a slow speed during the second/third section, and a fast speed during the final 500 m, independently of boat typology. These findings substantiate the knowledge that when highly selected, trained and experienced rowers compete tip-to-tip to achieve a medal, the analysis of the race strategy could offer opportunities to anticipate the tactical decisions of the opponents and to plan training programmes to help athletes managing and controlling the race demands.

Practical Applications

The present study carried on young rowers who participated in the Youth Olympic Games showed that during the final A race, athletes who adopted a negative race strategy with faster performances during the second half of the race had the highest chances of winning. Thus, coaches should be encouraged to use this information on technical determinants of rowing success as a valuable reference to effectively develop training plans that are more coherent to an effective race strategy. In particular, to improve the tactical approach to the race, coaches should closely evaluate the psycho-physical capabilities of their youth athletes. With respect to the physiological aspects, traditionally VO_2max of rowers is considered a relevant parameter (8, 17), the present findings advise coaches to focus also on the anaerobic component, which could allow athletes effective initial spurts and final rushes during the race (6,17,20). Consequently, training should aim to improve the anaerobic capability of youth rowers, especially at the beginning and at the end of aerobic rowing bouts to replicate the desired race strategy. To this purpose, in-door rowing ergometers and global positioning systems (GPS) could be valuable tools to monitor the actual rowing training and performances of the athletes. In particular, indoor rowing ergometers could provide data on several parameters (e.g., watts, speeds, stroke rates, calories, and distances in meters) during the different phases of a performance, whereas GPS dedicated to rowing on water could inform coaches on the speed, distance, and stroke rates during ecological training conditions. In this regard, the information provided relative to the speed could be used to set specific training intensities to prepare the athletes for international competitions. Indeed, coaches of youth rowers should place a particular attention the technical aspects of this sport, especially during high intensity performances when youth athletes might suffer fatigue effects, which could have a detrimental effect on rowing efficiency.

References

1. Abbiss, CR, and Laursen, PB. *Describing and Understanding Pacing Strategies during Athletic Competition. Sports Med 38: 239-252, 2008.*
2. Akça, F. Prediction of Rowing Ergometer Performance from Functional Anaerobic Power, Strength and Anthropometric Components. J Hum Kinetics 41:133-142, 2014.
3. Boisseau, N, and Delamarche, P. Metabolic and hormonal responses to exercise in children and adolescents. Sports Med 30:405-422, 2000.
4. *Brown, MR, Delau, S, and Desgorces,* FD. Effort regulation in rowing races depends on performance level and exercise mode*. J Sci Med in Sport 13: 613-617, 2010.*
5. Capranica, L, and Millard-Stafford, ML. Youth Sport Specialization: How to Manage Competition and Training? Int J Sports Physiol Perform 6: 572-579, 2011.
6. Cataldo, A, Cerasola, D, Russo, G, Zangla, D, and Traina, M. Mean power during 20 sec all-out test to predict 2000-m rowing ergometer performance in national level young rowers. J Sports Med Phys Fitness 55: 872-877, 2015.
7. Cerne, T, Kamnik, R, Vesnicer, B, Zganec Gros, J, and Munih, M. Differences between elite, junior and non-rowers in kinematic and kinetic parameters during ergometer rowing. Hum Mov Sci 32: 691-707, 2013.
8. Cosgrove, MJ, Wilson, J, Watt, D, and Grant, SF. The relationship between selected physiological variables of rowers and rowing performance as determined by a 2000-m ergometer test. J Sports Sci 17: 845-852, 1999.
9. *De Koning, JJ, Bobbert, MF*, and *Foster, C. Determination of optimal pacing strategy in track cycling with an energy flow model. J Sci Med Sport 2: 266-277, 1999.*

10. Fédération Internationale des Sociétés d'Aviron (2017). Publications. Available at http://www.worldrowing.com/fisa/publications/ retrieved on June 20, 2017.

11. Foster, C, Snyder, AC, Thompson, NN, Green, MA, Foley, M, and Schrager, M. Effect of pacing strategy on cycle time trial performance. Med Sci Sports Exerc 25: 383-388, 1993.

12. Foster, C, de Koning, JJ, and Hettinga, F. Pattern of energy expenditure during simulated competition. Med Sci Sports Exerc 35: 826-831, 2003.

13. Garland, SW. An analysis of the pacing strategy adopted by elite competitors in 2000 m rowing. Br J Sports Med 39: 39-42, 2005.

14. Gee, TI, French, DN, Gibbon, KC, and Thompson, KG. Consistency of Pacing and Metabolic Responses During 2000-m Rowing Ergometry. Int J Sports Physiol Perform 8: 70-76, 2013.

15. Hagerman, FC, Garret, WE, and Kirkendall, DJ, eds. Exercise and sport science. Baltimore, MD: Lippincott,Williams & Wilkins, 2000.

16. *Ingen Schenau, GJ, De Koning, JJ,* and *de Groot, G. Optimisation of sprinting performance in running, cycling and speed skating. Sports Med 17: 259-275, 1994*

17. Ingham, SA, Whyte, GP, Jones, K, and Nevill, AM. Determinants of 2000 m rowing ergometer performance in elite rowers. Eur J Appl Physiol 88: 243-246, 2002.

18. Kennedy, MD, and *Bell, GJ. Development of Race Profiles for the Performance of a Simulated 2000- m Rowing Race. Can J Appl Physiol 28: 536-546, 2003.*

19. Kleshnev, V, and Nolte, V. Racing strategy in rowing during Sydney Olympic Games. Australian Rowing 24: 20-2, 2001-

20. Maciejewski, H, Rahmani, A, Chorin, F, Lardy, J, Giroux, C, and Ratel S. The 1,500-m rowing performance is highly dependent on modified Wingate anaerobic test performance in national-level adolescent rowers. Pediatr Exerc Sci 28: 572-579, 2016.

21. Mikulic, P, and Ruzic, L. Predicting the 1000m rowing ergometer performance in 12-13-year-old rowers: The basis for selection process? J Sci Med Sport 11: 218-226, 2008.

22. Mikulic, P1, Smoljanovic, T, Bojanic, I, Hannafin, J, and Pedisic, Z. Does 2000-m rowing ergometer performance time correlate with final rankings at the World Junior Rowing Championship? A case study of 398 elite junior rowers. J Sports Sci 27: 361-366, 2009.

23. Mountjoy M, Armstrong N, Bizzini L, Blimkie, C, Evans, J, Gerrard, D, Hangen, J, Knoll, K, Micheli, L, Sangenis, P, and Van Mechelen, W. IOC consensus statement: "training the elite child athlete. Br J Sports Med 42: 163-164, 2008.

24. Muehlbauer, T, Schindler, C, and Widmer, A. Pacing pattern and performance during the 2008 Olympic rowing regatta. Eur J Sport Sci 10: 291-296, 2010.

25. Rowland, TW, and Cunningham, LN. Influence of aerobic and anaerobic fitness on ventilator threshold in children. Med Sci Exerc Sport 28: 147, 1996.

26. Secher, NH, Espersen, M, Binkhorst, RA, Andersen, PA, and Rube, N. Aerobic power at the onset of maximal exercise. Scand J Sports Sci 4:12-16, 1982.

27. Secher, NH. The Physiology of Rowing. J. Sports Sci 1: 23-53, 1983.

28. Thompson, KG, Maclaren, DPM, Lees, A, and Akinson, G. The effects of changing pace on metabolism and stroke characteristics during high-speed breaststroke swimming. *J Sports Sci* 22: 149-157, 2004.

29. Tran, J, Rice, AJ, Main, LC, Gastin, PB. Profiling the training practices and performances of elite rowers. *Int J Sports Physiol Perform* 10(5):572-80, 2015.

30. Tucker, R, Lambert, MI, and Noakes, TD. An Analysis of Pacing Strategies During Men's World-Record Performances in Track Athletics. Int J Sports Physiol Perform 1: 233-245, 2006.

31. van Ingen Schenau, GJ, de Koning, JJ, and de Groot, G. The distribution of anaerobic energy in 1000 and 4000 metre cycling bouts. Int J Sports Med 13: 447-451, 1992.

Captions to figure and tables

Table 1. Means and SD of average speed during T1 and T2 of the scull (1x), two coxless (2-) of female and male not-qualified (NQ), qualified (Q), not-medallist (NM), and medallist (M) athletes.

Figure 1. Schematic representation of the competitive phases and the number of boats involved in the 2014 Youth Olympic Games.

Figure 2. Means and standard deviation of T1 and T2 expressed as a percentage of the average speed of the whole race of female and male qualified (Q) and not-qualified (NQ) rowers for the Final-A of the 1xJ and 2-J races.

Figure 3. Means and standard deviation of T1 and T2 expressed as a percentage of the average speed of the whole race of female and male medalists (M) and not-medalists (NM) rowers of the 1xJ and 2-J races.

Figure 4. Frequency of occurrence (%) of positive, negative, and even pacing of medallists (M) and not-medallists (NM) rowers during the final phase of the competition.

Table 1

	Females				Males			
	1x		2-		1x		2-	
Preliminary Phases	NQ	Q	NQ	Q	NQ	Q	NQ	Q
T1 (m·s^{-1})	4.18±0.2	4.36±0.04	4.74±0.2	4.86±0.2	4.65±0.2	4.81±0.1	5.13±0.1	5.21±0.1
T2 (m·s^{-1})	4.04±0.3	4.27±0.1	4.52±0.2	4.84±0.1	4.38±0.3	4.64±0.1	5.05±0.1	5.17±0.1
	1x		2-		1x		2-	
Final Phase	NM 1x	M 1x	NM 2-	M 2-	NM 1x	M 1x	NM 2-	M 2-
T1(m·s^{-1})	4.23±0.2	4.32±0.1	4.90±0.05	4.92±0.1	4.63±0.04	4.57±0.04	5.15±0.04	5.21±0.1
T2 (m·s^{-1})	4.18±0.2	4.36±0.1	4.75±0.1	5.05±0.1	4.44±0.1	4.63±0.04	5.07±0.1	5.23±0.1

Fig. 1

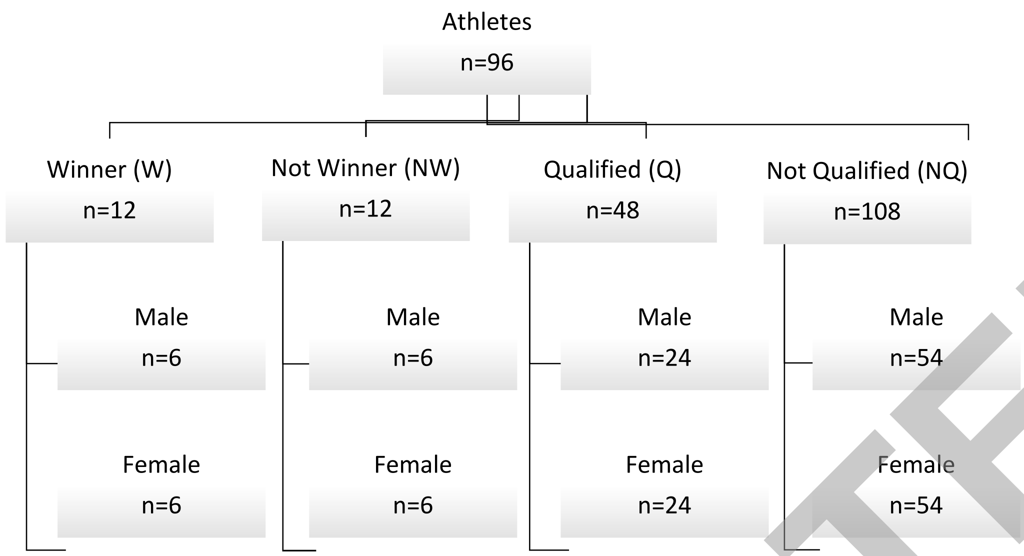

Athletes
n=96
Winner (W)
n=12
Not Winner (NW)
n=12
Qualified (Q)
n=48
Not Qualified (NQ)
n=108
Male
n=6
Female
n=6
Male
n=6
Female
n=6
Male
n=24
Female
n=24
Male
n=54
Female
n=54

Fig.2

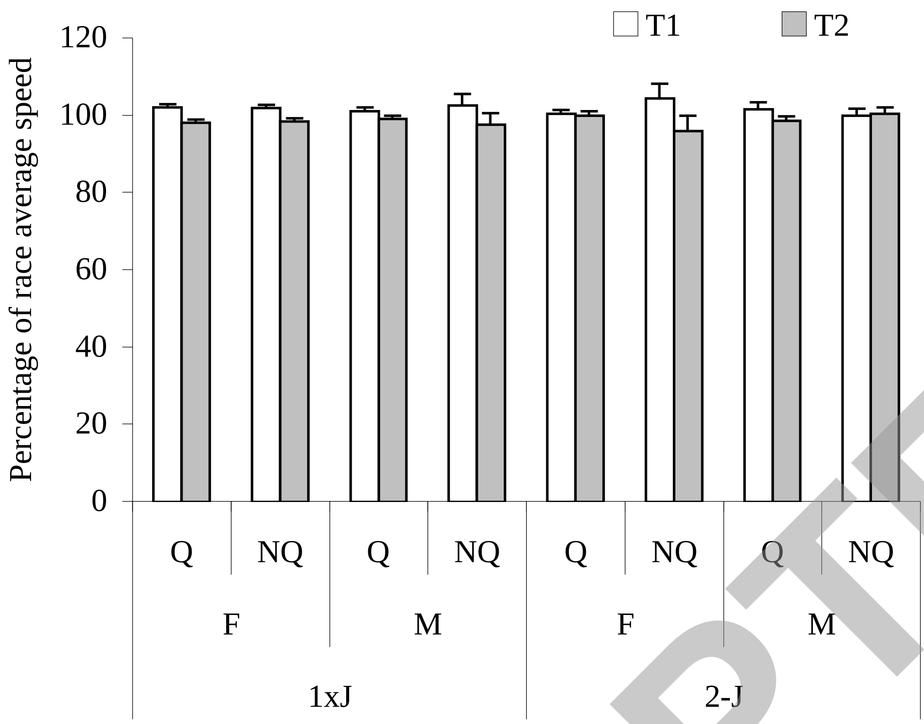

T1
T2
Percentage of race average speed
120
100
80
60
40
20
0
Q
NQ
Q
NQ
Q
NQ
Q
NQ
F
M
F
M
1xJ
2-J

Fig 3

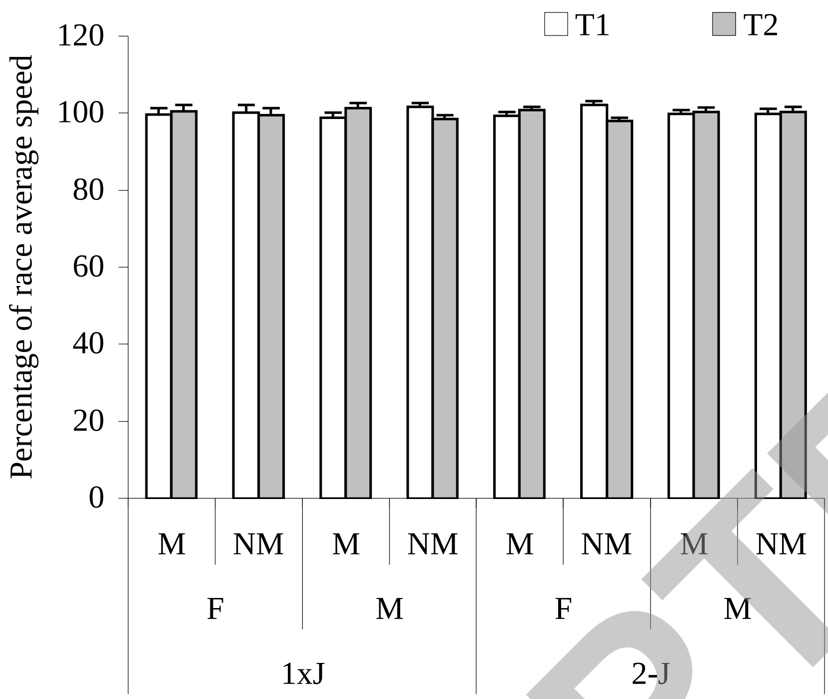
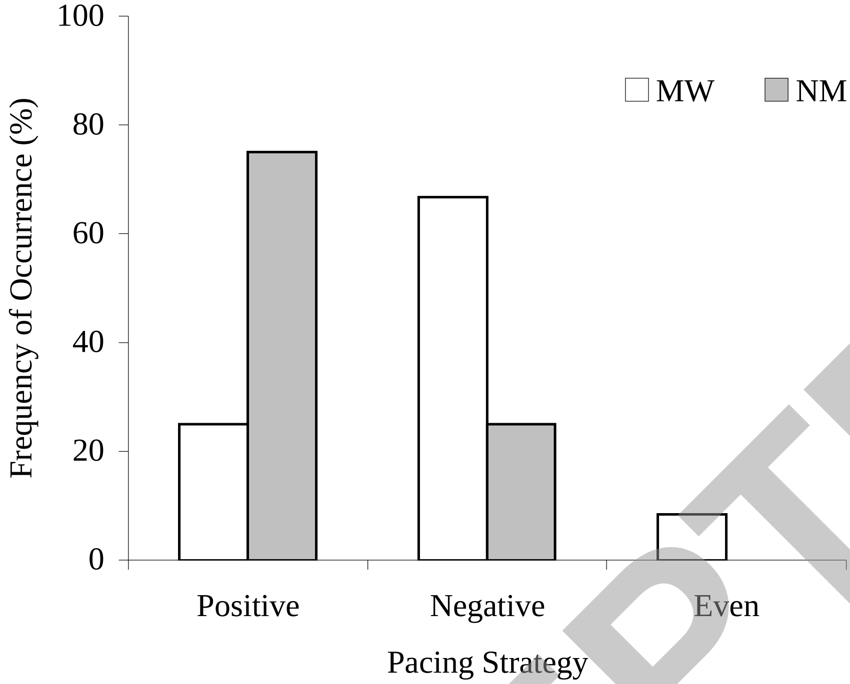

T1
T2
120
100
80
60
40
20
0
Percentage of race average speed
M
NM
M
NM
M
NM
M
NM
F
M
F
M
1xJ
2-J

Fig. 4


100
80
60
40
20
0
Frequency of Occurrence (%)
MW
NM
Positive
Negative
Even
Pacing Strategy