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The Competition Strategies For 20 Km Female Race-Walking Based On Lap Variables

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ABSTRACT

Purpose: It is important to set the correct pace throughout the competition in the race-walking. It is seen as an important performance component for trainers to develop a strategic plan for race-walking competitions. The aim of this study is to create models according to the average speed change attitude of the athletes divided into different performance groups according to the results of the major race-walking competitions. **Material & Method:** The study findings from the results of the competitions, the 2 km lap times in the competitions were recorded for each athlete. By using these times, the averages of the lap transition speeds of the athletes were calculated both cumulatively and separately for each 2 km. **Findings:** Based on the findings, velocity variation models were created in three different performance groups. When the models are designing, the groups are podium athletes (Model A), the athletes (Model B) with better results than the Olympic entry standard, and the athletes (Model C) with below performance than the Olympic entry standard. It was seen that the highest speed value reached by the athletes within the scope of Model C in 2 km laps was accepted as 100% (3.51 m/s between 2-4 km), and an advantageous result could be achieved at the rate of 3.8% when the speed percentage distributions of Model A were applied to this group. If the competition speed percentage distributions of Model B are applied, this rate rises to 7.8%. The podium athletes (Model A) reached their maximum speed (3.8 m/s) in the 16-18 km phase of the competition, while the lowest speed was between 0-2 km with 3.64 m/s. It is a striking finding that the group with the lowest starting speed among the three models was in Model A, the podium athletes' group. **Results:** As a result, three different competition strategy models based on the speed variables of the athletes in different performance groups were introduced with the current research. To targeted competition results, coaches can use these models to create their own performance strategies or adapt these models according to their priorities.
Keywords: Athletics, 20 km walking race, competition

Tur Değişkenlerine Göre 20 Km Kadın Yürüyüş Yarışı Müsabaka Stratejileri

ÖZET

Amaç: Yürüyüş müsabakalarında yarışma boyunca doğru hızın ayarlanması önemlidir. Antrenörlerin yürüyüş yarışı müsabakaları için stratejik bir plan geliştirmeleri önemli bir performans bileşeni olarak görülmektedir. Bu çalışmanın amacı, yürüyüş yarışmaları müsabakalarının sonuçlarına göre farklı performans gruplarına ayrılan sporcuların ortalama hız değişim davranışlarına göre modeller oluşturmaktır. **Materyal & Metot:** Müsabakalardan elde edilen çalışma bulguları, müsabakalarda 2 km ara geçiş süreleri her sporcu için kayıt altına alınmıştır. Bu süreler kullanılarak sporcuların tur geçiş hızlarının ortalamaları hem kümülatif hem de her 2 km için ayrı ayrı hesaplanmıştır. **Bulgular:** Bulgulara dayalı olarak üç farklı performans grubunda hız değişim modelleri oluşturulmuştur. Modeller oluşturulurken gruplar podyum sporcuları (Model A), olimpiyat barajından daha iyi sonucu olan sporcular (Model B) olimpiyat barajından daha zayıf yarışma sonucuna sahip olan sporcular (Model C) şeklinde düzenlenmiştir. Model C kapsamındaki sporcuların ortalama 2 km aralıklarda eriştiği en yüksek hız değeri %100 kabul edilerek (2-4 km arası 3,51 m/s) Model A yarışma hız yüzde dağılımları uygulanırsa yarışma sonucu 01:37:12 şeklinde sonuçlanmaktadır. Model B'nin yarışma hız yüzde dağılımlarının uygulanması durumunda %7,8 oranında sporcular avantajlı olmaktadır. Üç model arasında en düşük başlama hızına sahip grubun podyum sporcuları grubu olan Model A'da olması dikkat çekici bir bulgudur. **Sonuç:** Sonuç olarak, mevcut araştırma ile farklı performans gruplarındaki sporcuların hız değişkenlerine dayalı üç farklı müsabaka stratejisi modeli ortaya konulmuştur. Antrenörler hedeflenen müsabaka sonuçlarını elde etmek için bu modelleri kullanarak kendi performans stratejilerini oluşturabilir ve bu modelleri önceliklerine göre uyarlayabilir.
Anahtar Kelimeler: Atletizm, 20 km yürüyüş yarışı, müsabaka

INTRODUCTION

Dissimilar from the other running events, the adventure of race walking as an Olympic event is relatively new. In the history of the Olympic Games the 20 km walking competition for the men competitors was first held in 1956 Melbourne and for women competitors it was held in 2000 Sydney Olympic Games. Both the men's (1:16:36) and the women's (1:23:49) Olympic records were broken during the 2012 London Olympics. The average speed of 20 km race-walking Olympic records are 4.23 m/s for men and 3.92 m/s for women. However, the average speed of the world records for 20km race walking is 4.35 m/s for men and 3.98 m/s for women. Due to the physiological profiles of elite race walkers who may reach very high speeds are like those of elite long-distance runners, the majority of studies in the walking events are based on physiological variables (Drake et al., 2003; Jelonek et al., 2017; Ma, 2021; Yoshida et al., 1989) or biomechanical analyses that examine the technique (Di Gironimo et al., 2016; Hanley et al., 2011). The researches about walking race speed has also been carried out In the recent years (Alves et al., 2021; Menting et al., 2021; Pupiš et al., 2016).

As the definition of Race Walking is that it is a progression of steps so taken that the race-walker makes contact with the ground, so that no visible (to the human eye) loss of contact occurs. In addition, the World Athletic (WA) competition rulebook (Rule.230) clearly states that the footwork must remain upright from the first contact with the ground until the moment it reaches the perpendicular position to the ground, i.e., the knee must not be bent (IAAF, 2017). Although restricting factors at this level, it is highly surprising that speeds of race walkers may exceed 4 m/s. The average speed (4.35 m/s) of the men's 20 km walking world record (1:16:36) is equal to the average speed of the time 38:20.00 in the 10,000 metres run. Perhaps this comparison can help us to understand better the average walking speed of the world record of 20 km.

It is quite important to determine the proper pace at the beginning of the race and then maintaining it with the determined strategy, in terms of performance in the walking competitions. Creating an individual competition strategy, which might be defined as race management, starts with preparing for the race. Management continues throughout the race, and it is completing with the evaluation of the race. It is necessary to create a competition strategy based on diagnosis and should implement it in the training process. In addition to the training quality of the athletes will do all year long, creating a competitive strategy will lead the athlete to the success which they aimed. When preparing for the race, the fact that coaches develop a strategic plan for walking competitions should be considered as an important component (Pupiš et al., 2016). In the literature review, there were no studies that determined the competition strategy based on 20 km lap transition times in the 20 km women's race walking.

The aim of this study, which examines the speeds in major walking competitions (in terms of speed changes in different parts of the race), to guide athletes about creating their own performance strategies before the competition by identifying the race sections where the maximum speed is reached in different performance groups, according to their training situation.

MATERIAL & METHOD

This study is an observational study which was conducted with publicly accessible data. The study data were obtained from the World Athletics (WA) official website. Data are available online in an unprocessed format and because of that the study were not collected through experimentation, they are not of ethical concern, as noted by Morley and Thomas (2005).

The research data consists of female athletes' results (n= 233) in the six major competitions of the race walking which been held between 2019-2022.

	Competition Name	Date	Location
1	World Athletics Championships	29.09.2019	Doha / QAT
2	European Race Walking Team Championships	16.05.2021	Podebrady / CZE
3	Olympic Games	06.08.2021	Sapporo / JPN
4	World Athletics Race Walking Team Championships	04.03.2022	Muscat / OMA
5	World Athletics Championships	15.07.2022	Oregon /USA
6	European Athletics Championships	20.08.2022	Münih /GER

The results of the competitions were taken from published on the official results page of the World Athletics, the 2 km lap times in the competition were recorded for each athlete. Using these lap periods, the averages of the intermediate transition speeds of the athletes were calculated both in cumulatively and separately for each 2 km.

When the models are designing, the (Model A) groups are podium athletes, the athletes with better results than the Olympic entry standards (2020 Tokyo RW standard for women 1:31:00) are (Model B) and the athletes with a slower competition result than the Olympic entry standards are arranged in the group of (Model C).

RESULTS

Athletes who reached the podium (the first three athletes of each competition) in the competitions examined within the scope of the research, according to the groups the one who performed better and worse than the Olympic entry standards, the demographic information of the athletes and the values of some competition variables are given in the tables below.

Table 1. *Demographic information of the athletes examined within the scope of the research according to different performance groups and some competition variables*

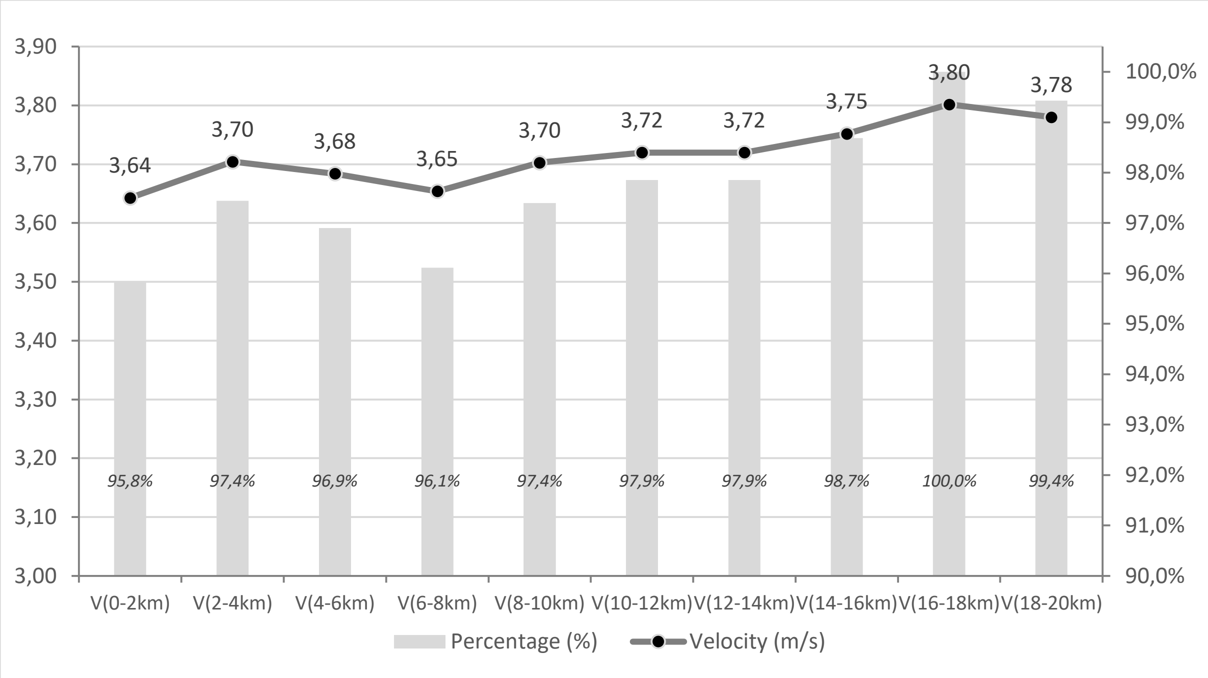
	Podium Athletes (n=18)				Better results from the Olympic Entry Standards (n=33)				Worse results from the Olympic Entry Standards (n=200)			
	Mean	***SD***	***Min***	***Max***	***Mean***	***SD***	***Min***	***Max***	***Mean***	***SD***	***Min***	***Max***
Age (year)	28,3	4,1	21,1	38,4	28,3	5,1	21,6	38,4	26,8	5,6	19,2	42,2
PB (hh:mm:ss)	1:27:11	0:02:01	1:23:49	1:30:24	1:28:15	0:01:46	1:24:27	1:32:02	1:31:59	0:04:44	1:23:49	1:55:33
Comp. Hour	15:33	4:24	10:15	23:58	13:25	1:58	10:15	16:30	16:28	4:05	10:15	23:58
Altitude (m)	243	193	3	520	284	170	32	520	192	171	3	520
Weather ©	24,0	6,9	14,0	31,0	21,2	6,7	14,0	31,0	25,5	6,5	14,0	31,0
Humadity (%)	66,0	14,7	43,0	91,0	63,3	16,7	43,0	91,0	64,2	11,1	43,0	91,0
PB-Difference (%)	3,1%	3,9%	-2,7%	9,7%	1,3%	2,1%	-2,7%	6,5%	7,4%	5,2%	-8,8%	23,5%

The values of some competition variables of the athletes (the first three athletes of each competition) who took the podium in the competitions examined within the scope of the research are given in the table below.

Tablo 2. *Findings of the 2 km lap transition times of the podium athletes*

	n	Mean	SD	Min	Max	Skewness	Std. Error	Kurtosis	Std. Error
2km (hh:mm:ss)	18	0:09:09	0:00:21	0:08:44	0:09:45	0,44	0,54	-0,95	1,04
4km (hh:mm:ss)		0:18:10	0:00:36	0:17:22	0:19:14	0,69	0,54	-0,40	1,04
6km (hh:mm:ss)		0:27:13	0:00:51	0:26:02	0:28:49	0,79	0,54	0,02	1,04
8km (hh:mm:ss)		0:36:21	0:01:10	0:34:46	0:38:31	0,78	0,54	0,02	1,04
10km (hh:mm:ss)		0:45:22	0:01:20	0:43:31	0:47:51	0,78	0,54	0,08	1,04
12km (hh:mm:ss)		0:54:20	0:01:32	0:52:14	0:57:10	0,76	0,54	0,00	1,04
14km (hh:mm:ss)		1:03:18	0:01:43	1:00:59	1:06:26	0,70	0,54	-0,16	1,04
16km (hh:mm:ss)		1:12:11	0:01:52	1:09:43	1:15:36	0,70	0,54	-0,17	1,04
18km (hh:mm:ss)		1:20:58	0:01:56	1:18:25	1:24:28	0,73	0,54	-0,35	1,04
20km (hh:mm:ss)		1:29:49	0:02:04	1:26:58	1:33:17	0,52	0,54	-1,04	1,04

The 2 km lap speed values of the athletes (the first three athletes of each competition) who reached the podium in the competitions was examined within the scope of the research and their percentage distributions are given in the graph below.



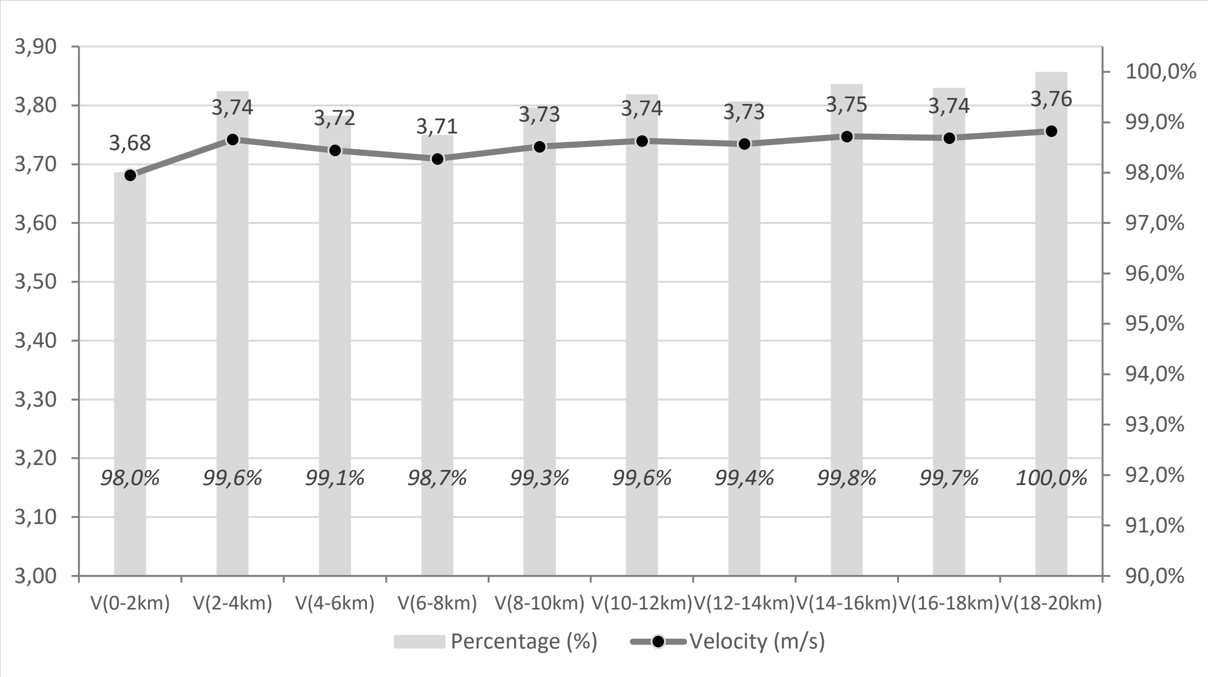
Graph 1. *The 2 km lap speeds and percentages of podium athletes.*

In the competitions examined within the scope of the research, the values of the 2 km lap times of the athletes who completed the competition better than the Olympic Games entry standards (01:31:00), which determined by the World Athletics Council, are given in the table below.

Table 3. *Findings of athletes performing at the Olympic entry standards level regarding the 2 km lap times*

	n	Mean	SD	Min	Max	Skewness	Std. Error	Kurtosis	Std. Error
2km (hh:mm:ss)	33	0:09:03	0:00:14	0:08:44	0:09:27	0,14	0,41	-0,96	0,80
4km (hh:mm:ss)		0:17:58	0:00:20	0:17:22	0:18:37	0,33	0,41	-0,48	0,80
6km (hh:mm:ss)		0:26:55	0:00:26	0:26:02	0:27:44	0,07	0,41	-0,29	0,80
8km (hh:mm:ss)		0:35:54	0:00:36	0:34:46	0:36:52	0,08	0,41	-0,74	0,80
10km (hh:mm:ss)		0:44:51	0:00:40	0:43:31	0:45:58	0,10	0,41	-0,21	0,80
12km (hh:mm:ss)		0:53:46	0:00:45	0:52:14	0:55:03	0,15	0,41	-0,11	0,80
14km (hh:mm:ss)		1:02:41	0:00:51	1:00:59	1:04:06	0,09	0,41	-0,29	0,80
16km (hh:mm:ss)		1:11:35	0:00:52	1:09:43	1:13:01	-0,33	0,41	-0,37	0,80
18km (hh:mm:ss)		1:20:30	0:00:54	1:18:25	1:21:53	-0,72	0,41	-0,30	0,80
20km (hh:mm:ss)		1:29:23	0:00:59	1:26:58	1:30:38	-0,81	0,41	-0,21	0,80

In the competitions examined within the scope of the research, the values of the 2 km lap times of the athletes who completed the competition better than the Olympic Games entry standards (01:31:00), which determined by the World Athletics Council, are given in the graphic below.



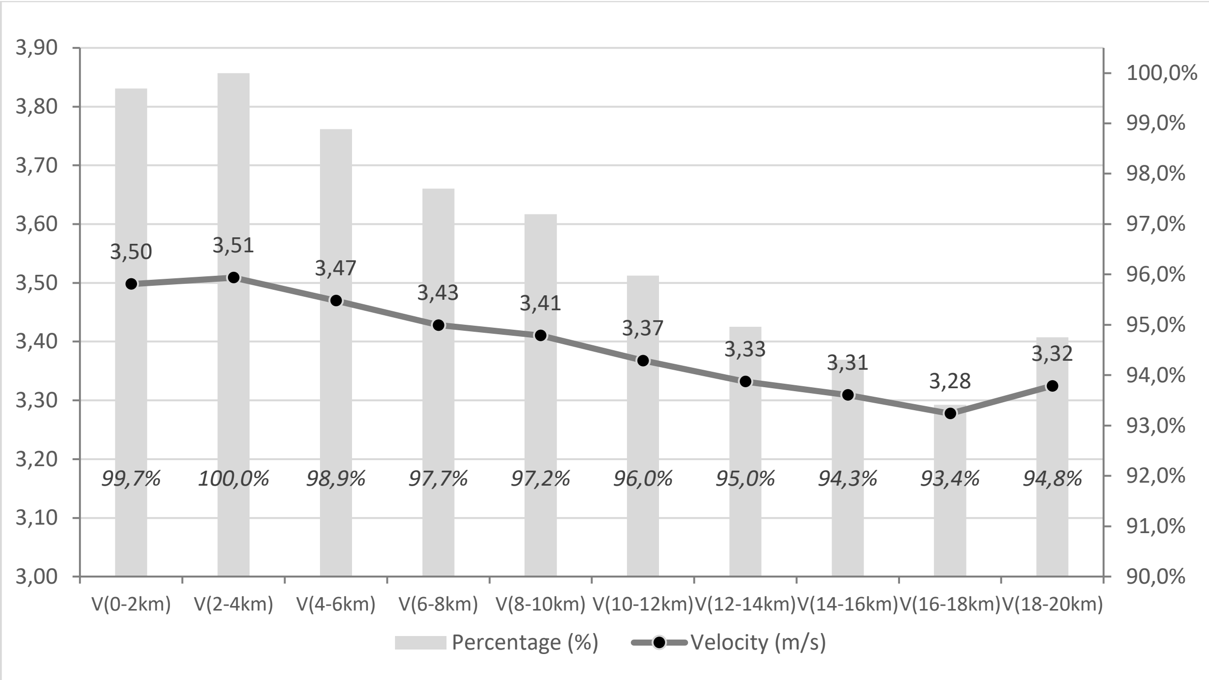
Graph 2. *2 km lap speed and percentage values of athletes performing at the Olympic entry standards level*

In the competitions examined within the scope of the research, the values of the 2 km lap times of the athletes who completed the competition worse/slower than the Olympic Games entry standards (01:31:00), which determined by the World Athletics Council, are given in the table below.

Tablo 4. *Findings of athletes who has performed worse than Olympic entry standards level regarding the 2 km lap times*

	n	Mean	SD	Min	Max	Skewness	Std. Error	Kurtosis	Std. Error
2km (hh:mm:ss)	200	0:09:32	0:00:25	0:08:26	0:10:56	0,51	0,17	0,76	0,34
4km (hh:mm:ss)		0:19:03	0:00:49	0:17:35	0:21:39	0,91	0,17	0,91	0,34
6km (hh:mm:ss)		0:28:41	0:01:14	0:26:31	0:32:59	0,95	0,17	0,93	0,34
8km (hh:mm:ss)		0:38:26	0:01:43	0:35:22	0:44:42	0,92	0,17	0,89	0,34
10km (hh:mm:ss)		0:48:14	0:02:14	0:44:17	0:56:33	0,92	0,17	0,92	0,34
12km (hh:mm:ss)		0:58:11	0:02:47	0:53:27	1:08:21	0,90	0,17	0,94	0,34
14km (hh:mm:ss)		1:08:14	0:03:22	1:02:57	1:20:09	0,88	0,17	0,86	0,34
16km (hh:mm:ss)		1:18:21	0:03:59	1:11:55	1:32:48	0,87	0,17	0,81	0,34
18km (hh:mm:ss)		1:28:34	0:04:38	1:21:00	1:45:56	0,86	0,17	0,85	0,34
20km (hh:mm:ss)		1:38:39	0:05:11	1:31:04	1:58:23	0,89	0,17	0,87	0,34

In the competitions examined within the scope of the research, the values of the 2 km lap times of the athletes who completed the competition worse/slower than the Olympic Games entry standards (01:31:00), which determined by the World Athletics Council, are given in the graphic below.



Graph 3. *2 km lap speed and percentage values of athletes who has performed worse/slower than Olympic entry standards level*

According to the major competitions within the scope of the research, it is seen that the average lap speed values of 2km of the podium athletes and the athletes who perform at the Olympic entry standards level have similar graphs in the competition results of the athletes examined in different performance groups (Graphs 1 and 2). The slowest 2km average speed of the podium athletes was found to be at 95.8% of the maximum speed, i.e. there is a difference of 4.2% between the slowest speed and the maximum speed (Graph 1). For the athletes who performed at the Olympic entry standards level, this difference was calculated as 2% (Graph 2). When the competition results of the athletes with worse/slower performance than the Olympic entry standards are examined, it is seen that this difference increases to 6.6%

Another important finding is that the 2 km average race-walking lap speed of the athletes in the chart 1 and chart 2 groups follows a steadily increasing pace (approximately) towards the late kilometres of the competition. In the group of athletes whose findings in Graph 3 are examined, it is seen that they reach their maximum walking speed in the first kilometres of the competition. Contrary to the findings in other graphs, they were seen to complete the competition at the slowest walking speeds in the final parts of the competition.

Table 5. *2 km lap average walking speed values and percentage distributions of athletes in three different performance groups*

	Model A		**Model B**		**Model C**	
	(m/s)	**(%)**	**(m/s)**	**(%)**	**(m/s)**	**(%)**
0-2 km	3,64	95,8%	3,68	98,0%	3,50	99,7%
2-4 km	3,70	97,4%	3,74	99,6%	3,51	100,0%
4-6 km	3,68	96,9%	3,72	99,1%	3,47	98,9%
6-8 km	3,65	96,1%	3,71	98,7%	3,43	97,7%
8-10 km	3,70	97,4%	3,73	99,3%	3,41	97,2%
10-12 km	3,72	97,9%	3,74	99,6%	3,37	96,0%
12-14 km	3,72	97,9%	3,73	99,4%	3,33	95,0%
14-16 km	3,75	98,7%	3,75	99,8%	3,31	94,3%
16-18 km	3,80	100,0%	3,74	99,7%	3,28	93,4%
18-20 km	3,78	99,4%	3,76	100,0%	3,32	94,8%

Table 6. *According to competition speeds of Athlete's the planning of the Model C group with the percentage distributions of the Model A and Model B, 2 km lap walking speed values*

	Model A		**Model B**		**Model C**	
	(m/s)	**(%)**	**(m/s)**	**(%)**	**(m/s)**	**(%)**
0-2 km	3,36	95,8%	3,44	98,0%	3,50	99,7%
2-4 km	3,42	97,4%	3,50	99,6%	**3,51**	**100,0%**
4-6 km	3,40	96,9%	3,48	99,1%	3,47	98,9%
6-8 km	3,37	96,1%	3,47	98,7%	3,43	97,7%
8-10 km	3,42	97,4%	3,48	99,3%	3,41	97,2%
10-12 km	3,43	97,9%	3,49	99,6%	3,37	96,0%
12-14 km	3,43	97,9%	3,49	99,4%	3,33	95,0%
14-16 km	3,46	98,7%	3,50	99,8%	3,31	94,3%
16-18 km	**3,51**	**100,0%**	3,50	99,7%	3,28	93,4%
18-20 km	3,49	99,4%	**3,51**	**100,0%**	3,32	94,8%

In the table above, the highest walking speed achieved by the athletes under Model C during the competition was assumed to be 100% and the competition speed change was applied according to the competition percentage distributions in Model A and Model B. In the table below, the average time of 2km lap times is given if the race is planned according to the speed distribution percentages of the Model A and Model B.

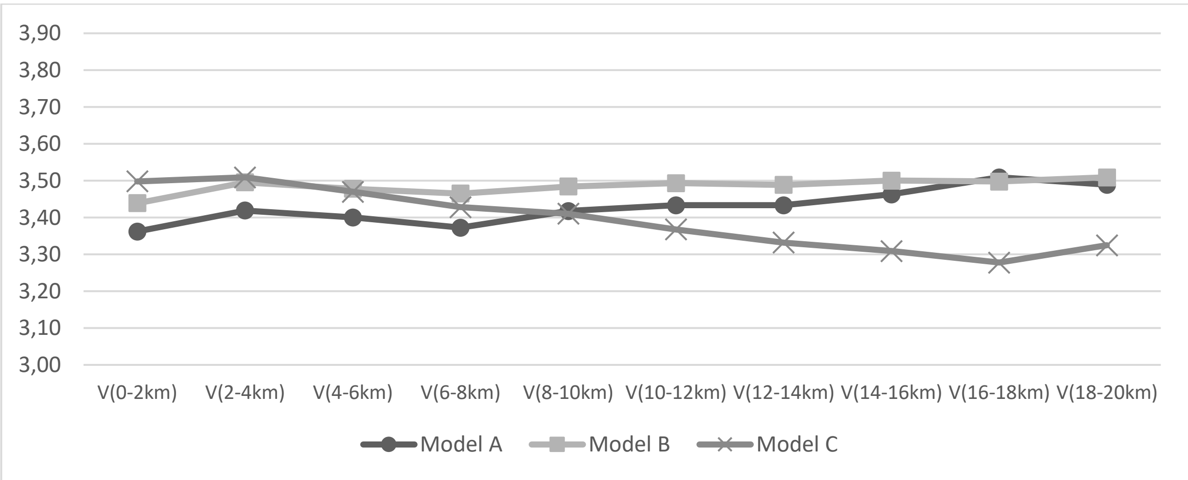
Table 7. *When the competition speeds of the athletes in the Model C group are planned according to the percentage distributions of the Model A and Model B, the estimated 2 km lap transition times*

	Model A		**Model B**		**Model C**	
	(m/s)	**(%)**	**(m/s)**	**(%)**	**(m/s)**	**(%)**
0-2 km	00:09:55	95,8%	00:09:42	98,0%	0:09:32	99,7%

0-4 km	00:19:40	97,4%	00:19:14	99,6%	0:19:03	100,0%
0-6 km	00:29:28	96,9%	00:28:49	99,1%	0:28:41	98,9%
0-8 km	00:39:21	96,1%	00:38:26	98,7%	0:38:26	97,7%
0-10 km	00:49:06	97,4%	00:48:00	99,3%	0:48:14	97,2%
0-12 km	00:58:49	97,9%	00:57:32	99,6%	0:58:11	96,0%
0-14 km	01:08:31	97,9%	01:07:06	99,4%	1:08:14	95,0%
0-16 km	01:18:09	98,7%	01:16:37	99,8%	1:18:21	94,3%
0-18 km	01:27:39	100,0%	01:26:09	99,7%	1:28:34	93,4%
0-20 km	**01:37:12**	99,4%	**01:35:39**	100,0%	**1:38:39**	94,8%

In the table above the Model C group athletes average finishing time been calculated as 1.38.39. The highest speed value reached by these athletes at 2km laps is considered as 100% (3.51 m/s between 2-4km). If the Model A competition speed percentage distributions had been applied, the result of the competition could have been 01:37:12. If the Model B's competition speed percentage distributions were applied, the result could be 01:35:39. In another words, if the Model A or Model B could applied by the athletes would reach with Model A an advantage of 3.8% and Model B with 7.8%.

The graph below shows application comparisons of Model A and Model B percentiles based on velocity of 3.51 m/s, which is the 100% value of Model C.



Graph 4. Scatter graph based on speed change percentages of models

DISCUSSION and CONCLUSION

The purpose of this study is to investigate to determine the race sections where the maximum speed was reached in different performance groups in walking competitions and to guide the athletes to create their own performance strategies according to their training situations before the competition. In the literature review, as in the current studies, there is no study that composed about competition strategy which based on speed changes due to 2 km lap transition times in the race-walking.

According to Pupiš et al. (2016), when developing a competition strategy, firstly the goal of the athlete must be well defined. After examining the performance and the strategy of the other competitor athletes, the current situation of the athlete should be evaluated, and the strategy should be decided according to the environmental conditions.

According to the findings of the current study, podium athletes (Model A) reach their maximum speed (3.8 m/s) in the range of 16-18 km during the competition, while the lowest speed was in the range of 0-2 km with 3.64 m/s. It is a striking finding that the group with the lowest initial speed among these three models is the Model A, that the group of podium athletes. The athletes who perform below the Olympic entry standards reach high speeds in the first kilometres of the race, that causing speed losses to increase in the last kilometres of the race. In Model B, which consists of athletes who are better than the Olympic entry standard in the current research, athletes start with 98% of the maximum speed in the first kilometres of the race and reach 100% in the last 2 kilometres of the race.

In the study, which examined the speed variables of 12 race walking events in which a Slovak female walker competed between 2011 and 2014, the best result of the competitions in that the athlete achieved 1:34:13 (Pupiš et al., 2016). When the 2 km lap transition times of this competition were calculated and adapted to the Model B competition strategy in the current, it was seen that the athlete's competition result would be 01:33:14. If the athlete had strategized according to the Model B, she could have been able to perform about a minute better. If the Model A competition speed change strategy created in the current study was applied, it was seen that the athlete would underperform her performance (01:34:44). It should be underlined that Model A is the competitive strategy of the podium athletes (Mean= 1:29:49). This situation shows that competition strategy models should be determined according to the current potential of the athlete.

According to the 2 km lap crossing times of the four Turkish female athletes who competed in the 22nd Balkan Walking Championships which held in Antalya, they would have performed 6% better on average if the Model A strategy of the current study had been applied (ABAF, 2023). It was observed that if the same athletes competed according to the Model B strategy, their performance could be better on average 7%. The best result of the competition (01:29:56) of the Greek athlete, who is women's Balkan champion in the same competition, is very close to the Paris 2024 Olympic Games entry standard of 01:29:20. If this athlete had applied the Model B strategy, the predicted competition result would have been 01.29.16 which is better than Olympic entry standard. The Turkish athlete, who came second with the time of 01:33:49

at the Balkan walking championships, would have been able to reach a performance (6 seconds), which is very close to the Olympic entry standard (6 seconds) with an estimated time of 01:29:26, if he also applied the Model B.

As a result of the current research, three different competition strategy models depending on the speed variables of athletes in different performance groups have been revealed. It is recommended that coaches try these models and develop their own models and strategies depending on different variables and training priorities.

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