TRENDS IN CHANGES OF ELITE SPORTSWOMEN' TECHNIQUE, SPECIALIZING IN 20 KM RACE WALK, CONSIDERING RISING OF THEIR SPORTS RESULTS

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Abstract. *Purpose:* on the base of bio-mechanical characteristics' analysis determination of trends in technique's changes of elite sportswomen, specializing in 20 kilometers' race walk, with rising of their sport results. *Material:* the research covered 13 elite sportswomen, specializing in 20 kilometers' race walk (396 measurements). *Results:* bio-mechanical characteristics of the best 20 kilometers' race walk sportswomen at Ukrainian championships 2014-2015 have been elucidated. Comparative analysis of elite sportswomen, having different sport results, has been conducted. *Conclusions:* improvement of sportsmanship to world level (from 1:38:37 to 1:31:35) takes place at the account of increasing of step length to 1.10 m (S = 0,01); shortening of phase of single support X average = 0.26 sec.; S = 0.01) owing to reduction of shock absorption time to 0.08 sec.
Key words: trends, sportswomen, race walk, technique.

Introduction

Level of results of the most important world 20 kilometers' race walk championships' winners among women has being constantly raises. For example, the best in the world 11sportswomen of 2014 showed the highest achievements at main start – world cup in Thai Tsagn (China). Alongside with it requirements to sportswomen's technical and physical fitness also grow. It requires detail analysis and further improvement of training process at stages of preparation to highest achievements and maximal realization of individual potentials [1, 3, 6, 15].

In race walk sport result depends on special endurance, which is determined by organism's ability to keep balance between demand in oxygen and its consumption during long period of time. Sport result also depends on technique of competition exercise's fulfillment. Considering long period of its fulfillment, perfection of technical skillfulness is realized in close connection with training of special endurance and is one of the most important directions in optimizing of sportsmen's training in general [7, 8, 10, 11, 14].

Basing on analysis of trends in changes of sportswomen's technique it is possible to realize rational choice of the most effective means of technical training and determine their specific orientation. It will permit to determine methodic approaches to technique's assessment and potentials of further improvement of sportswomen's technical skillfulness.

Some scientific works elucidate basis for solution of this problem [2, 5, 13, 17, 19]. That is why there exists a demand in further seeking of ways for sport results' perfection through rising sportswomen's technical skillfulness.

Purpose, tasks of the work, material and methods

The purpose of the research: is to determine trends in changes of technique of 20 kilometers' sportswomen-race-walkers, depending on their sport results.

Material and methods: for solution of our tasks we used analysis of scientific-methodic literature, pedagogic observations, video-recording and computer analysis of sportswomen's motor functioning, methods of mathematical statistics.

Bio-mechanical analysis of 13 sportswomen' technique of competition exercise's fulfillment was carried out on the base of video-recording of Ukrainian race walk championships: 2014 – in Alushta and Sumy; 2015 in Ivano-Frankovsk. With it, some sportswomen participated in both starts. Total quantity of sport results was 18. Bio-mechanical characteristics were registered at three parts of distance – 2, 10 and 18 kilometers. For more convenient perception of material we present in this article averaged bio-mechanical characteristics, which were calculated as mean arithmetic from three components (total quantity for every indicator – 54).

Analysis of video records was conducted with the help of program complex «Lumax», main performance characteristics and potentials of which are described in detail in publications of developers [9].

Registration of body positions in fulfillment of competition exercise was realized with video camera «Sony DCR-SR 65» at speed of 25 frames per second with further division of them in 50 semi frames.

In the course of the research we considered all metrological requirements. It permitted to correctly locate camera and minimize systemic and random mistakes. For digitization of frames we used 20-links model of human body. With it points were marked in strict sequence.

In the course of the research sportswomen were divided in two groups by their results (see table 1). Every group was uniform by level of results, anthropometrical and bio-mechanical characteristics (with exclusion of only indicators of flight duration). Value of variation coefficient did not exceed 10 %. We compared main bio-mechanical characteristics of athletes' technique with world level of sport results (first group – results higher than standard of

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international master of sports of Ukraine) and sportswomen with lower level of achievements (second group – results were higher than standard of master of sports of Ukraine).

Sportswomen of both groups did not differ by main anthropometrical parameters – body length and body mass.

Results of the research

In race walk result depends on mean speed of movement, which, in its turn, depends on length and frequency of steps. Thus, registration of these characteristics and determination of their correlation is the basis of assessment of race walk's technique [11, 14].

For achieving of world level results in 20 kilometers' race walk length of steps at competition distance shall be within 1.06–1.19 m with frequency of 3.34–3.60 step per sec.$^{-1}$ [4, 16, 18]. These indicators and their correlation can vary in different sportsmen and depend on body height (length of legs) and level of technical and physical fitness. Table 1

Bio-mechanical characteristics of elite sportswomen, specializing in 20 kilometers' race walk (n=54)

Group	Sportswoman	Характеристика												
		result	Height, cm	Body mass, kg	Average speed, m·p.sec.$^{-1}$	Length of step, m	Frequency of steps step·p.sec.$^{-1}$	Time of single support, sec.	Flight time, sec.	Time of shock absorption in phase of single support, sec.	Angle of foot setting on ground, degrees	Angle of pushing off, degrees	Angle in knee joint, degrees	K_a
I	K-na	1:30:17	163	49	3.69	1.11	3.33	0.26	0.04	0.08	66.50	44.11	178.84	0.68
	Sh-na	1:30:41	160	48	3.68	1.10	3.33	0.25	0.05	0.08	65.02	42.24	178.08	0.69
	B-ka	1:32:35	163	50	3.60	1.08	3.33	0.26	0.04	0.08	65.53	44.16	178.73	0.66
	Ya-uk	1:32:46	167	53	3.59	1.10	3.28	0.27	0.04	0.08	64.94	44.28	178.24	0.66
	$\bar{x}$	**1:31:35**	**163**	**50.00**	**3.64**	**1.10**	**3.32**	**0.26**	**0.04**	**0.08**	**65.50**	**43.70**	**178.47**	**0.67**
	S	**1:17**	**2.9**	**2.16**	**0.05**	**0.01**	**0.03**	**0.01**	**0.01**	**0**	**0.72**	**0.97**	**0.37**	**0.01**
	V	**1**	**2**	**4**	**1**	**1**	**1**	**3**	**12**	**0**	**1**	**2**	**0.2**	**2**
II	K-na	1:34:51	163	49	3.51	1.05	3.33	0.27	0.03	0.10	65,70	46.27	179.09	0.64
	Ya-ko	1:34:36	167	53	3.52	1.04	3.39	0.26	0.04	0.10	65.32	50.17	178.94	0.62
		1:37:59	167	53	3.40	1.02	3.33	0.26	0.04	0.09	65.41	47.25	179.63	0.61
	V-ik	1:35:24	168	53	3.49	1.08	3.23	0.28	0.03	0.09	65.35	43.7	178.39	0.64
	M-uk	1:36:45	165	53	3.45	1.03	3.33	0.28	0.02	0.11	64.86	38.79	178.12	0.62
		1:39:34	165	53	3.35	1.04	3.23	0.27	0.04	0.10	65.33	44.72	177.98	0.63
	K-ych	1:37:02	168	48	3.44	1.06	3.23	0.27	0.04	0.10	65.06	44.71	178.74	0.63
		1:38:15	168	48	3.39	1.05	3.23	0.28	0.03	0.10	65.89	43.35	178.34	0.63
	T-ych	1:37:28	170	55	3.42	1.06	3.23	0.28	0.03	0.10	65.44	45.35	177.94	0.62
	P-iuk	1:38:05	165	53	3.40	1.05	3.23	0.28	0.03	0.10	65.36	44.44	178.06	0.64
	K-l	1:40:13	158	48	3.33	1.00	3.33	0.26	0.04	0.10	65.95	44.65	178.83	0.63
		1:39:42	158	48	3.34	1.00	3.33	0.26	0.04	0.08	65.56	41.43	179.01	0.63
	R-ko	1:40:43	162	50	3.31	1.03	3.23	0.28	0.03	0.11	64.28	44.92	178.92	0.64
	O-ka	1:40:58	168	59	3.30	1.02	3.23	0.28	0.03	0.11	64.06	43.38	178.74	0.61
	$\bar{x}$	**1:38:37**	**165**	**51.64**	**3.40**	**1.04**	**3.28**	**0.27**	**0.03**	**0.10**	**65.26**	**44.51**	**178.62**	**0.63**
	S	**2:06**	**3.7**	**3.27**	**0.07**	**0.02**	**0.06**	**0.01**	**0,.01**	**0.01**	**0.54**	**2.62**	**0.50**	**0.01**
	V	**2**	**2**	**6**	**2**	**2**	**2**	**3**	**19**	**8**	**1**	**6**	**0.3**	**2**
	p*	p<0.01	p>0.05	p>0.05	p<0.01	p<0.01	p>0.05	p<0.05	p<0.05	p<0.01	p>0.05	p>0.05	p>0.05	p<0.01

* – criterion of Manna-Witny

As it is shown in table 1 mean indicators of step length of more qualified sportswomen were 1.10 m (S = 0.01), athletes of second group had 1.04 m (S = 0.02) ($p < 0.01$). With it, it is important that increasing of step length does not result in reducing of angle of foot setting on ground and increasing of pushing off angle. In its turn frequency of steps of first group sportswomen was insignificantly higher than in second group and was accordingly: 3.32 step p.sec.$^{-1}$ (S = 0.03) and 3.28 step p.sec.$^{-1}$ (S = 0.06) ($p > 0.05$). Thus, improvement of sport result is resulted from, mainly, increasing of step length. It also is proved by confident differences in coefficients of anthropometrical data usage (correlation of step length and height of a sportswoman). Athletes of the first group have this coefficient at level of advanced world sportswomen: $K_a = 0.67$ (S = 0.01) [12].

If to speak about time of flight then its value also influence on step length. For example, more qualified sportswomen have it by 0.01 second higher. With mean speed it gives advantage in step length of about 3.7 cm. However, such trend can not be regarded as promising one, as far as further increasing of flight phase will result in its visual detection and disqualification. That is why it is important to analyze characteristics of mobility in hip joints, which also influence on step length [18].

It should be noted that increasing of step length and frequency to large extent depends on effectiveness of pushing off. More effective fulfillment of it by advanced world sportswomen is witnessed by indicator of duration– $\bar{x}$ = 0.26 sec. (S = 0.01). It is, in average, by 0.01 sec. More than in second group ($p < 0.05$). It is also important that shortening of pushing off time happens at the account of decreasing of shock absorption time in phase of single support up to 0.08 sec. (second group sportswomen have it equal to 0.10 sec. $p < 0.01$). With it time of pushing off phase increases by 0.01 sec. All these witness about higher effectiveness of power interaction with support. It is conditioned by corresponding manifestation of speed-power abilities together with special endurance.

Discussion

The received results prove demand in seeking of new ways of sport results' perfection for improvement of race walkers' sportsmanship [2, 18]. In our researches we determined that improvement of sport results in 20 kilometers' race walking takes place at the account of step length's increasing. It supplements the data of other scientists [16, 17, 19].

We also found out that important indicator of assessment and further perfection of race walkers' technique was coefficient of usage of anthropological parameters. Determination of this coefficient's values permits to create preconditions for individualization of training process of sportswomen.

For further perfection of elite sportswomen's technical skillfulness the direction of the first priority is seeking of the most effective means, oriented on increasing of sportswomen's step length with maintaining or increasing of step frequency.

Conclusions

In the process of our researches we analyzed bio-mechanical characteristics of elite sportswomen's technique, who specialize in 20 kilometers' race walk. With it, it was found that improvement of result up to world level (from 1:38:37 to 1:31:35) to large extent happens at the account of increasing of step length to 1.10 м (S = 0.01), shortening of single support phase ($\bar{x}$ = 0.26 sec.; S = 0.01) mainly due to reducing of shock absorption time up to 0.08 sec.

One of important directions of further researches is determination of characteristics of power interaction with support as well as seeking of more efficient means of technical training of elite sportswomen-race walkers.

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Conflict of interests

Authors declare absence of any conflict of interests.

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