
VARIABILITY OF RESULTS IN SPRINTING AND MIDDLE-DISTANCE RUNNING ACHIEVED BY OLYMPIC GAMES FINALISTS FROM 1968 TO 2012

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Key words:

- Olympic Games,
- running,
- finalists.

Abstract:

The purpose of this study is an analysis of variability of results in sprinting (100, 200, 400m) and middle distances running (800, 1500m) achieved by Olympic Games finalists. It includes the period of time from Olympic Games in Mexico (1968) to London Olympics (2012). The results achieved by Olympic champions and medal winners as well as average results of all final running events participants and athletes who finished in positions fourth to eight were examined. The final component of evaluation is an attempt to define the disproportions between medalists and other finalists. In order to illustrate the trends observed in that area, regression coefficients were calculated and approximate lines of regression were determined.

INTRODUCTION

The contemporary sports make heavy demands on athletes involving psychophysical dispositions and in consequence, a continuous searching for new organizational and training solutions that increase the fitness level of individual athletes and, at the same time, lead to optimization of training loads [8, 9, 10]. The consequence of those activities is an improvement of athletes' results that is visible, especially in sports having a measurable character. Athletics is one of those sports, in which after the period of fantastic individual achievements that were to a large extent effect of prohibited pharmacological support, some stagnation or even regression followed [6]. That trend is especially visible at the world's most important athletic events. One should remember, however, that the fitness levels of the best athletes are very close to each other, and often it is very difficult to determine the winner (leader) of individual athletic events [7].

Apart from genetic predispositions and making use of them in the process of training and the above mentioned organizational and training solutions, sports results depend on continuous technological progress leading to new qualities in the field of equipment and sports facilities (new surfaces, better quality of personal equipment, universal access to information involving the athlete's fitness level, or changing regulations) [1, 3, 4, 5].

The purpose of this study is an attempt to analyze the results in running events over distances from 100 m to 1500 m achieved by men – finalists of Olympic Games from 1968 to 2012, and trends observed in that area.

MATERIALS AND METHODS

Materials for this study are results achieved by Olympics finalists in both men's and women's five running events, i.e. 100, 200, 400, 800, 1500m run. Twelve successive finals,

from Olympic Games in Mexico (1968) to London Olympics (2012), were analyzed [2]. The analyze includes as follows:

1. results achieved by Olympic gold medalists;
2. average results achieved by Olympic medalists;
3. average results achieved by athletes who finished in places fourth to eight;
4. average results achieved by all athletes participating in finals (in 1500 m run, results of only eight finalists were taken into consideration);
5. percentage differences between results achieved by medalists and athletes who finished in positions fourth to eight;

In order to obtain information concerning disproportions between medalists and other final runs participants, regression coefficient was calculated from percentage differences, based on which approximate lines of regression were determined.

DISCUSSION OF RESULTS

At the Olympic Games in Mexico, running events were for the first time staged on running tracks covered with synthetic material and the competitions took place at a considerable altitude. It is believed that both of those factors had an impact on a significant progress of results, especially in events in which speed and strength are decisive factors [1, 7].

Table 1. Results in sprinting and middle-distance running achieved by Olympic games (women)

Competition	Place	1968	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012
100 m	I	11,0	11,07	11,08	11,06	10,97	10,54	10,82	10,94	11,12	10,93	10,78	10,75
	I-III	11,07	11,18	11,13	11,09	11,09	10,74	10,83	10,95	11,16	10,95	10,91	10,78
	IV-VIII	11,38	11,61	11,29	11,25	11,42	11,14	11,04	11,09	11,23	11,09	11,13	10,94
	I-VIII	11,26	11,45	11,23	11,19	11,29	10,99	10,96	11,03	11,20	11,04	11,05	10,88
	%**	2,80	3,85	1,44	1,44	2,98	3,72	1,94	1,29	0,63	1,28	2,02	1,48
200 m	I	22,50	22,40	22,37	22,03	21,81	21,34	21,81	22,12	22,27	22,05	21,74	21,88
	I-III	22,67	22,53	22,41	22,14	21,98	21,67	21,97	22,25	22,30	22,18	21,89	22,04
	IV-VIII	23,04	22,93	22,90	22,67	22,46	22,20	22,46	22,52	22,50	22,71	22,40	22,57
	I-VIII	22,90	22,78	22,72	22,47	22,28	22,00	22,28	22,42	22,41	22,51	22,21	22,37
	%**	1,63	1,78	2,19	2,39	2,18	2,45	2,23	1,21	0,90	2,32	2,33	2,40
400 m	I	52,00	51,08	49,28	48,88	48,83	48,65	48,83	48,25	49,11	49,41	49,62	49,55
	I-III	52,10	51,31	50,11	49,33	49,10	49,33	49,17	48,66	49,47	49,62	49,75	49,66
	IV-VIII	52,74	52,08	50,95	51,06	50,51	50,88	50,16	49,95	50,19	50,24	50,40	50,23
	I-VIII	52,74	51,79	50,64	50,42	49,98	50,30	49,79	49,47	49,92	50,01	50,16	50,02
	%**	1,23	1,50	1,68	3,51	2,87	3,14	2,01	2,65	1,46	1,25	1,31	1,15
800 m*	I	120,90	118,55	114,94	113,43	117,60	116,10	115,54	117,73	116,15	116,36	114,87	116,19
	I-III	122,00	118,80	115,32	114,576	118,35	116,55	116,11	118,18	116,53	116,41	115,89	116,98
	IV-VIII	125,38	120,01	118,12	117,90	120,17	119,05	117,77	119,77	118,75	118,25	118,84	118,91
	I-VIII	124,11	119,56	117,07	116,65	119,49	118,11	117,14	119,18	117,92	117,56	117,73	118,19
	%**	2,77	1,02	2,43	2,91	1,54	2,15	1,43	1,35	1,91	1,58	2,55	1,65
1500 m*	I	-	241,38	245,48	236,56	243,25	233,96	235,30	240,83	245,10	237,90	240,23	250,23
	I-III	-	242,35	245,86	237,93	243,72	238,17	236,43	241,80	245,17	238,14	241,21	250,46
	IV-VIII	-	246,53	247,50	241,28	245,91	241,45	240,53	244,62	246,91	239,65	243,29	251,48
	I-VIII	-	244,96	246,89	240,03	245,09	240,22	238,99	243,56	246,26	239,08	243,51	251,10
	%**	-	1,72	0,68	1,41	0,90	1,38	1,73	1,17	0,71	0,63	0,86	0,41

*Results in those events in seconds, ** Percentage difference between medalists and athletes who finished in positions fourth to eight.

Table 2. Results in sprinting and middle-distance running achieved by Olympic games (man)

Competition	Place	1968	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012
100 m	I	9,9	10,14	10,06	10,25	9,99	9,92	9,96	9,84	9,87	9,85	9,69	9,63
	I-III	9,97	10,22	10,09	10,30	10,13	9,96	10,01	9,88	9,97	9,86	9,83	9,72
	IV-VIII	10,12	10,40	10,27	10,45	10,30	10,13	10,16	10,07	10,12	9,98	9,98	9,90
	I-VIII	10,06	10,33	10,21	10,39	10,24	10,06	10,10	9,99	10,05	9,93	9,92	9,82
	%**	1,50	1,76	1,78	1,46	1,68	1,71	1,50	1,90	1,50	1,22	1,53	1,85
200 m	I	19,80	20,00	20,23	20,19	19,80	19,75	20,01	19,32	20,09	19,79	19,30	19,32
	I-III	19,93	20,16	20,32	20,23	20,01	19,86	20,17	19,60	20,14	19,94	19,75	19,53
	IV-VIII	20,52	20,64	20,87	20,70	20,55	20,39	20,59	20,25	20,31	20,29	20,40	20,27
	I-VIII	20,30	20,46	20,63	20,52	20,35	20,19	20,44	20,00	20,25	20,14	20,08	19,99
	%**	3,01	2,38	2,71	2,32	2,67	2,67	2,08	3,32	0,84	1,75	3,29	3,79
400 m	I	43,80	44,66	44,24	44,60	44,27	43,87	43,50	43,49	43,84	44,00	43,75	43,94
	I-III	44,03	44,79	44,53	44,77	44,51	43,96	43,98	44,14	44,31	44,19	44,43	44,31
	IV-VIII	45,74	45,40	45,38	45,53	44,95	44,84	44,76	44,79	45,28	44,95	45,14	44,91
	I-VIII	45,10	45,14	45,06	45,24	44,76	44,51	44,47	44,51	44,92	44,67	44,87	44,68
	%**	3,88	1,36	1,91	1,70	0,99	2,00	1,77	1,47	2,19	1,72	2,29	1,35
800 m*	I	104,30	105,86	103,50	105,40	103,00	103,45	103,66	102,58	105,08	104,45	104,65	100,91
	I-III	104,73	105,89	103,83	105,73	103,49	103,80	103,78	102,70	105,13	104,57	104,72	101,72
	IV-VIII	107,58	106,93	106,12	107,29	106,72	106,58	106,08	104,14	105,69	106,78	105,78	103,21
	I-VIII	106,51	106,54	105,26	107,20	105,43	105,53	105,09	103,60	105,45	105,95	105,39	102,65
	%**	3,88	1,15	0,56	1,00	1,37	0,56	0,44	0,71	1,95	0,89	0,44	0,52
1500 m*	I	214,90	216,33	219,17	218,40	212,53	215,96	220,17	215,78	212,07	214,18	213,11	214,08
	I-III	217,20	216,87	219,26	218,73	213,41	216,11	220,49	216,30	212,28	214,39	213,83	214,67
	IV-VIII	225,62	219,36	220,49	220,93	216,34	217,33	221,47	217,84	216,42	216,31	214,78	215,79
	I-VIII	222,48	218,42	220,03	220,11	215,24	216,87	221,11	217,26	214,86	215,59	214,37	215,37
	%**	2,72	0,98	2,20	1,47	3,12	2,68	2,22	1,40	0,53	2,11	1,01	1,46

*Results in those events in seconds, ** Percentage difference between medalists and athletes who finished in positions fourth to eight.

100 m run

At the Olympic Games in Mexico, the winner of men's 100 run bet the 10-second limit. The average results achieved by medalists were also below that limit. Although in case of gold medal that barrier was exceeded again in 1984 (Los Angeles), the average results of the best three sprinters oscillate below that limit only from Olympic Games in Atlanta (1996) on. The average results achieved by competitors who finished in positions fourth to eight show that the 10-second limit was bet as late as in 2004 (Athens). There is a slight decrease in disproportions observed between the first three athletes and other final runs participants (Fig. 1, Table 1 and 2).

In women's 100 m run the best result achieved by the golden medalist (10,54) was recorded at the Olympic Games in Seoul (1988). The 11-second limit was for the first time exceeded in 1984 (Los Angeles). From that year on, the successive female Olympic champions achieved results below that limit (with the exception of Olympic Games in Sydney 2000). Four years later, at Olympic Games in Seoul, female Olympic medalists bet the 11-second limit and, similarly as in the case of Olympic female champions, that barrier is

systematically exceeded in successive finals. Female athletes who finished in positions fourth to eight got trough with that limit as late as during the latest Olympics in London (10,94). The distance between the female medalists and other final runs participants decreases systematically.

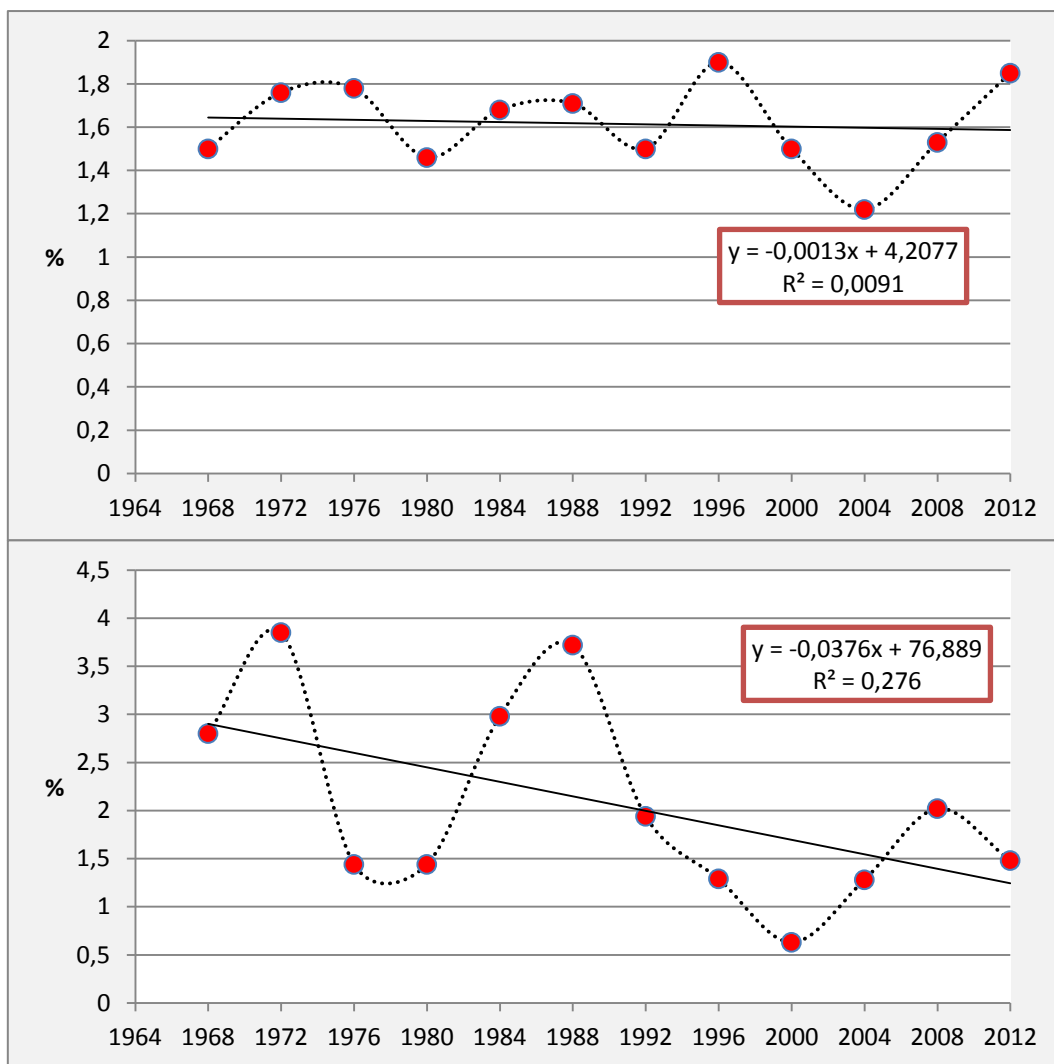


Fig. 1. Percentage difference between results in 100m runs achieved by medalists and athletes who finished in positions fourth to eight (top – men, bottom – women)

200 m run

In men’s 200 m run, the best winner’s result was recorded in 2008 at Olympic Games in Beijing. The 20-second barrier was exceeded by the medalists in 1968 (Mexico). In 2012, the final runs participants achieved the average result below that limit (19,99). Also athletes, who in 2012 finished in positions fourth to eight, feature the best average result. The largest distance between medalists and other participants of final runs was recorded during the Olympic Games in London. The analysis of regression lines shows that the difference between those above-mentioned groups tends to increase (Fig. 2, Table 1 and 2).

In women’s 200 m run, that distance was covered within the shortest time in 1988 (Seoul). Similarly, at those Olympics, female medalists, finalists and runners who finished in positions fourth to eight feature the best average result. The Olympic female champions have bet the 20-second barrier for five times (for the first time in 1984). The largest distance between female medalists and other final runs participants was recorded in 1988. Similarly to the case of men, the disproportions between those two women’s groups also tend to increase.

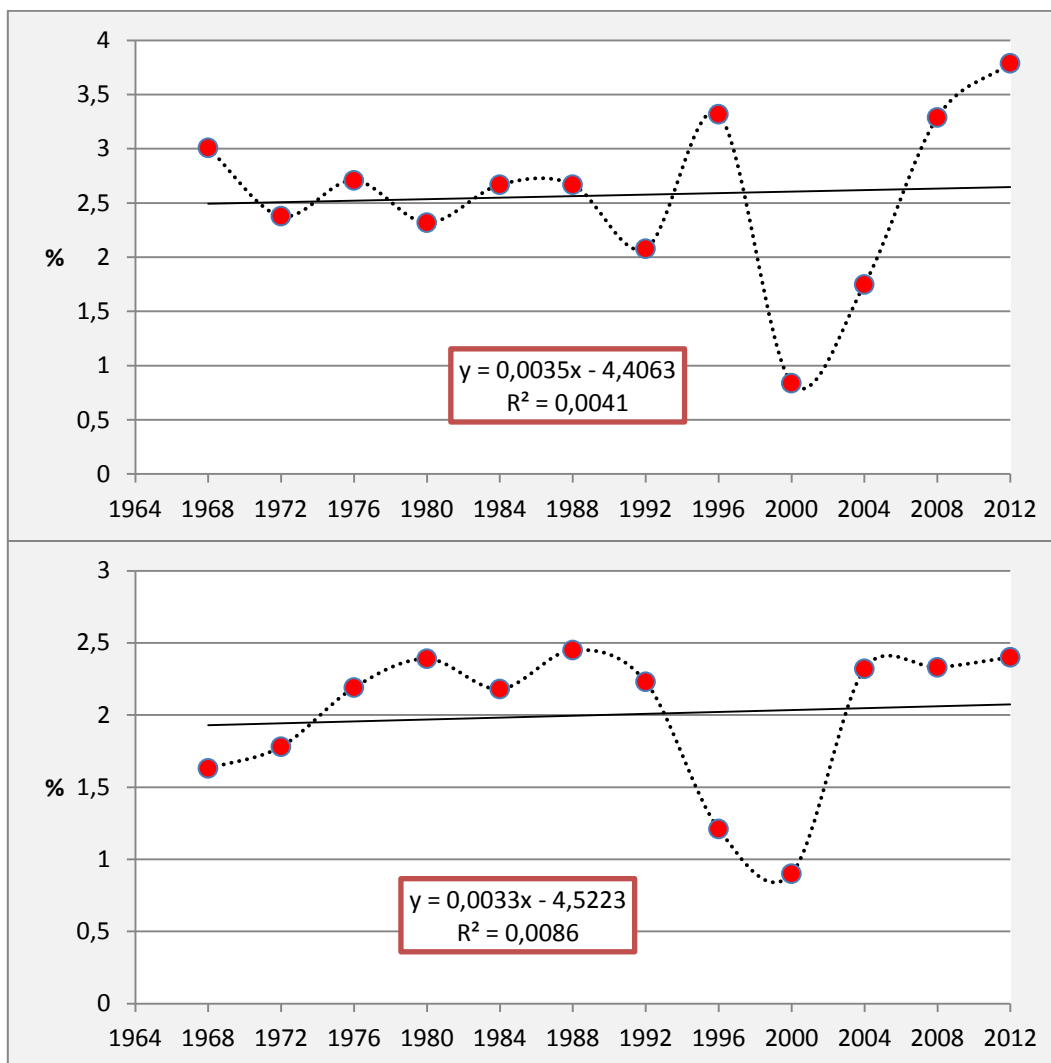


Fig. 2. Percentage difference between results in 200m runs achieved by medalists and athletes who finished in positions fourth to eight (top – men, bottom – women)

400 m run

The 44-second limit was bet for the first time by the winner of Olympic Games in Mexico. From 1988 on - except for Olympic Games in Seoul – Olympic champions achieved results below that limit. On the other hand, the medalists achieved the average result below 44 seconds just once, i.e. in 1988. The best average result of athletes who finished in positions fourth to eight and finalists was recorded at Olympic Games in Barcelona in 1992. The largest distance between medalists and other final runs participants was recorded at the Olympic Games in Mexico. The analysis of the extent of regression coefficient allows for the conclusion, that the distance between the first three and other participants of final runs over that distance shows a clear decreasing trend (Fig. 3, Table 1 and 2).

Among women, the 50-second barrier was exceeded in 1976 at the Olympic Games in Montreal. At every following Olympics, female Olympic champions achieved results below that limit. On the other hand, the medalists obtained the best average result in 1996 in Atlanta. At those Olympics, the best average result was achieved both by all final runs participants and female athletes who finished in positions fourth to eight. In 1980 in Moscow, the distance between the medalists and other runners was at the level of over 3,5%. From the analysis of

regression line it follows that within the whole researched period, a significant equalization of performance level is observed.

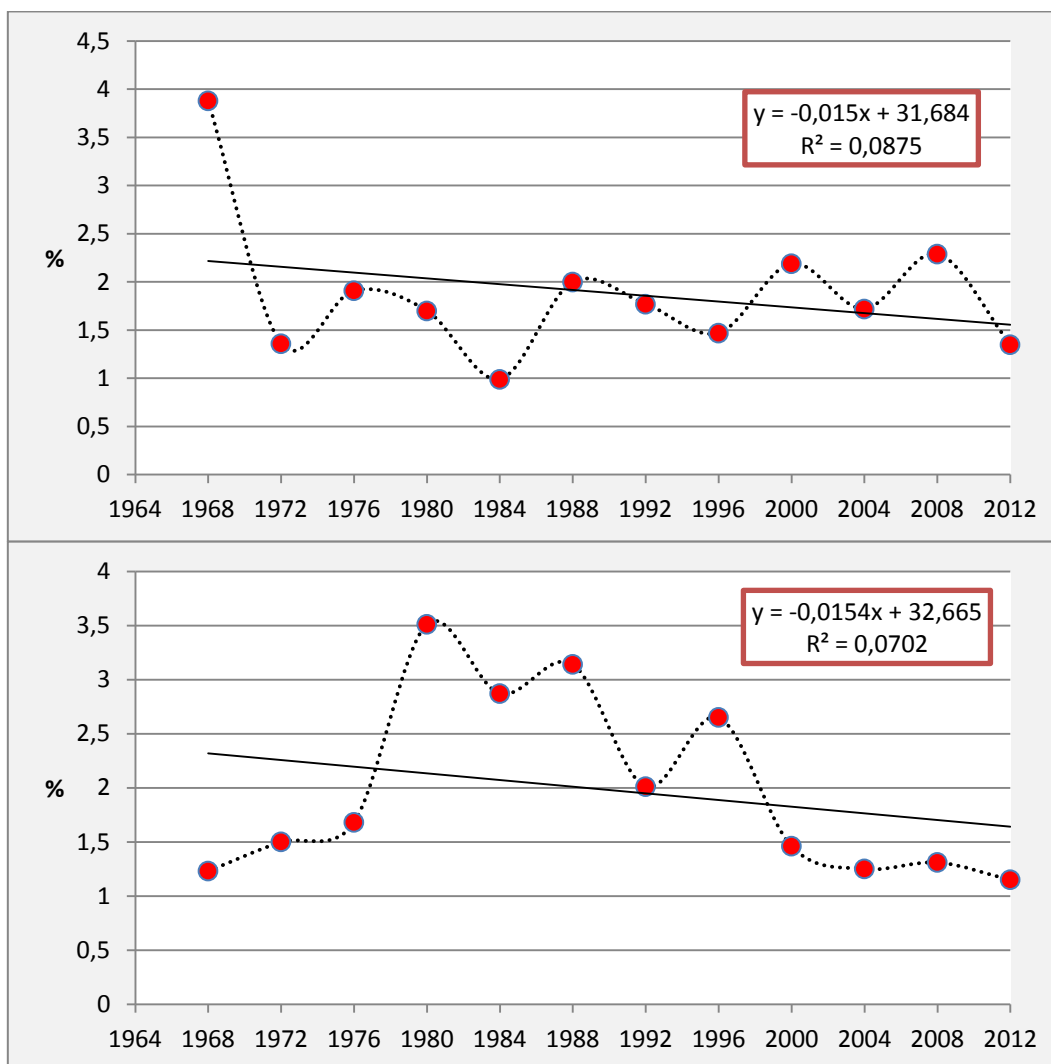


Fig. 3. Percentage difference between results in 400m runs achieved by medalists and athletes who finished in positions fourth to eight (top – men, bottom – women)

800 m run

The best result in the 800m run was achieved by the Olympic champion from London (2012). At the same Olympics, the best average result was obtained by medalists, athletes who finished in positions fourth to eight and final runs participants. The distance between medalists and other competitors was at the level of 0,454% - 1,95%. An exception from that rule was the Olympic Games in Mexico, at which disproportions between competitors amounted to almost 4%. The analysis of regression coefficient reveals that disproportions between the groups that were singled out, are of a radically decreasing nature (Fig. 4, Table 1 and 2).

In women's 800 m run, the Olympic Games in Moscow turned out to be record-breaking for both the winner and medalists (results 1:53,43 and 1:54,76, respectively). The finalists of that run recorded also the best average result. The greatest disproportions between medalists and other final run participants – at the level of ca. 3% - were noted at the Olympics in Mexico and Moscow. Those disproportions are, however, of significantly decreasing nature.

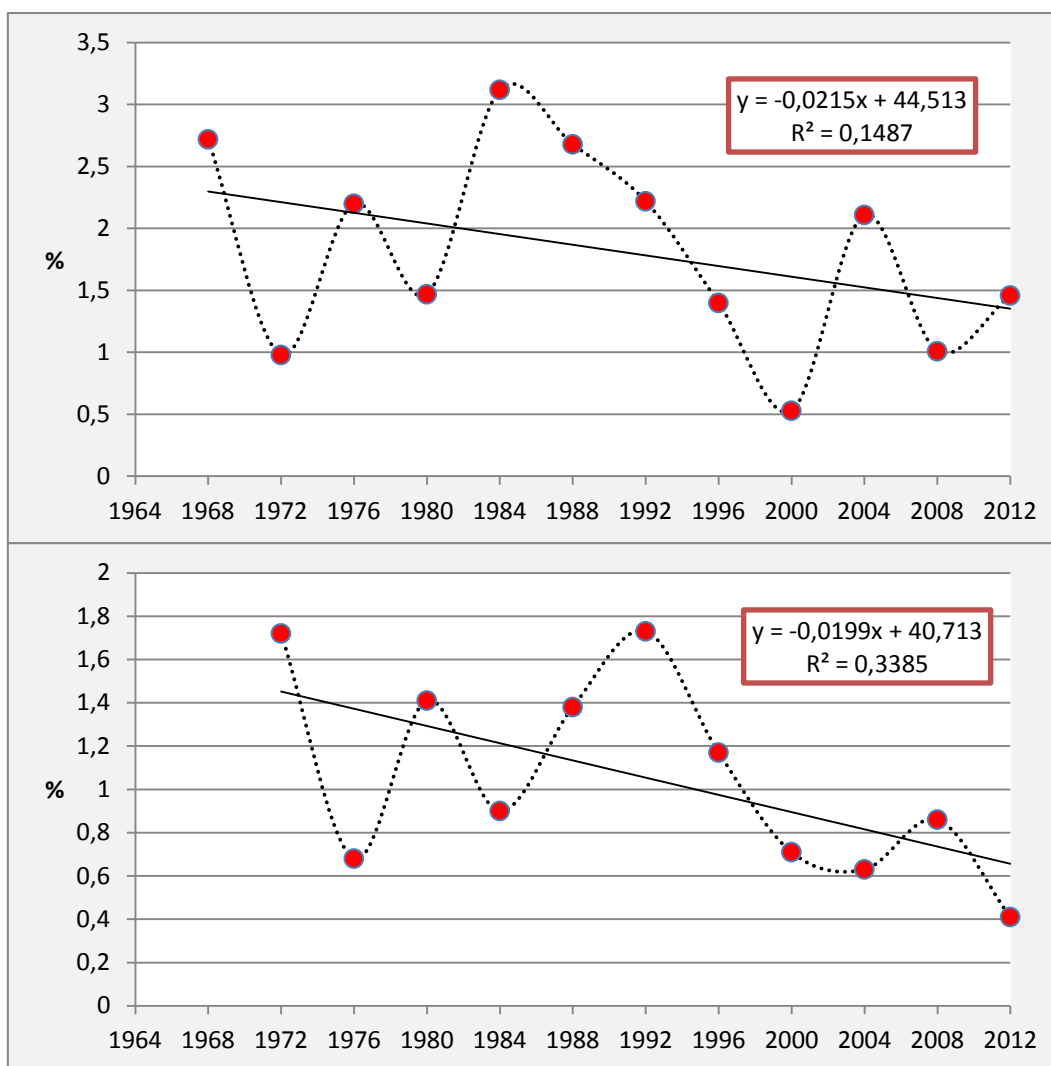


Fig. 5. Percentage difference between results in 1500m runs achieved by medalists and athletes who finished in positions fourth to eight (top – men, bottom – women)

1500 m run

In men's 1500 m run, the best result within the whole researched period of time was achieved by the Olympic winner in Sydney. At the same Olympics, Olympic medalists feature the best average performance level over that distance. On the other hand, the best average results of all finalists and athletes who finished in positions fourth to eight were recorded at the Olympics in Beijing (2008). The distance between medalists and other participants of finals was at the level from 3,12% (Moscow) to 0,53% (Sydney). From the analysis of regression coefficient it follows, that that distance tends to decrease (Fig. 5, Table 1 and 2).

The women's 1500m run was staged for the first time at the Olympics in Munich (1972). The best result was achieved by Olympic female champion from Seoul (1988). The best average performance level features in turn the female medalists from Barcelona (1992). At the same Olympics, the best average result of eight finalists and competitors that finished in positions fourth to eight, was recorded. At the latest Olympics in London, the distance between the medalists and other final run participants was very small and amounted to less than 0.5%. The analysis of regression line and regression coefficient reveals a very clear equalization of sports performance level of female final run participants.

SUMMARY AND CONCLUSIONS

The analysis of research results reveals the variability of results achieved by Olympic Games finalists in all examined running events. Nevertheless, not all of them feature similar dynamics of change. In women's events, the fastest growth rate of results was recorded in 400 m run, especially among gold medalists (7,77%), and the slowest growth rate was observed among female 200 m runners. In men's running events in turn, the 400m distance features the slowest growth rate of results within the entire researched period of time.

The conducted analysis allows the following conclusions:

1. The largest growth rate of results both in men's and women's running events was recorded among Olympic Games winners.
2. The largest growth rate of results in women's running events feature the distance of 400 m, contrary to men's events, where the recorded growth rate was the smallest and for all finalists, it did not exceed 2%.
3. In men's 100 m run, the distance between medalists and other participants of final runs remains generally at a constant level of about 1.5%; among women, those disproportions decrease clearly and the reduction rate of differences between groups is the largest.
4. In men's running events, the largest reduction rate of differences between sports performance levels feature the 800 m run.
5. In both men's and women's 200 m runs small, but constantly increasing disproportions between medalists and competitors who finished in positions fourth to eight can be observed.

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