VARIABILITY OF MEN'S ATHLETIC JUMPING RESULTS BASED ON THE EXAPLE OF OLYMPIC GAMES OVER THE PERIOD OF 1968-2012

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Key words:
- Olympic games,
- final competitions,
- athletic jumping,
- time series.

Abstract:

The purpose of this study is to analyze the variability of athletic jumping results achieved by the Olympic Games finalists. It involves the period from Olympic Games in Mexico (1968) to Olympics in London (2012). Results achieved by Olympic champions and medalists as well as the average results of all final competitions participants and athletes from positions 4-8 were examined. Another component of the analysis is an attempt to define disproportions between medalists and other finalists. The final component of the analysis is an attempt to determine the development index of those events over the examined period of time. In order to exemplify the tendencies occuring within that field, determination coefficients (R^2) were calculated and linear trends were determined.

INTRODUCTION

The development of the best results in the world's athletics was heterogeneous. After very dynamic increase of average results achieved by the world's leading 4eexzcathletes during the period up to 1990, a general decrease of development index during the following years was observed; however, it does not concern the individual record results [6,8,9]. Maszczyk argues, that the record results are determined by various accidental and immeasurable factors. Research results show that based on the analysis of arithmetic mean sequences of the 10 best results, the development trends within the individual events can be determined in a relatively accurate manner [8,9,10]. It is also believed that the growth rate of sports results will be possible thanks to the optimization of training loads, improvement of sporting selection by making use of a wider range of genetic methods, improvement of technique, equipment, and sports facilities, physiological and biochemical control, as well as using modern systems of psychomotor control [1,3,4,5,8].

Jumping is a kind of athletic events where disproportions between strength and speed are predominant and their level determines in a decisive manner the technique effectiveness [2,4,5]. In the long jump, the result of Bob Beamon, the winner Olympic Games in Mexico, is especially remarkable. The record distance of 8.90m achieved by him during the final competition has not been broken so far. In Nowak's opinion [10], the dynamics of results variability in that event will show an upward trend amounting to 15.7% for women and 11.9% for men. Moreover, the author suggests, that the limit values will be at the level of 9.65 m (men) and 8.64m (women) [10]. On the other hand, the limit values determined by Nowak [10] for high jump are at the level of 2.75 and 2.23, respectively.

For the triple jump, Olympic Games in Mexico were critical in terms of achieving results over 17 m [11]. The dynamics of results variability shows an upward trend amounting

to 11.7% (women) and 8.4% (men), and the limit values reach the level of 16.88 m and 19.53 m, respectively. [9,10].

According to Bohm [1], in pole vault, two factors have a direct impact on the results and variability dynamics, i.e. improvement and modification of technique and changes in equipment design. The limit values determined by Mleczko and Nowak oscillate at the level of 6.88 m for men and 5.95 m for women. [9,10].

The purpose of this study is to analyze the variability of results achieved by the Olympic Games finalists in four events, i.e. long jump, high jump, triple jump and pole vault, as well as an attempt to find out, which of those four events features the highest development index over period of time subjected to the research.

MATERIAL AND METHOD

Results achieved by Olympic Games finalists within the period of time from 1968 (Mexico) to 2012 (London) constitute material of this study [7]. The analysis involves results achieved in four athletic events, i.e. long jump, high jump, triple jump and pole vault. Results achieved by Olympic champions, average results of medalists (positions I-III), average results of all final competitions participants (positions I-VIII) and average results of athletes from positions IV-VIII were examined. Based on those data, the percentage difference between the results achieved by medalists and other participants of final competitions was analyzed. Those differences were used as basis for calculation of determination coefficients R2 and linear trends, showing tendencies taking place in this aspect.

At the final stage, percentage growth rates between the successive Olympic finals within the individual events were calculated. The complete collected material was expressed in a tabular form and presented graphically. The growth rates of results was calculated by formula:

$$\mathrm{GRR} = \frac{results_i - reselts_{i-1}}{reselts_{i-1}} * 100\%,$$

where: GRR - growth rates of results, $results_i$ – results of Olympic finals, $reselts_{i-1}$ – results of previous Olympic finals.

RESULTS AND DISCUSSION

Long jump

In 1968, Bob Beamon achieved during the final long jump competition the result of 8.90 m. That record has not been broken so far. Since the Olympic Games in 1988 (Seoul), a gradual regression of results achieved by Olympic champions can be generally observed. Among the medalists, the best average result was achieved in 1992 at the Olympic Games in Barcelona (1992), whereas in case of all final competitions participants the record achievement was achieved in Athens in 2004 (8.33m). The greatest distance – over 6% - between the medalists and athletes from positions IV-VIII was noted at the Olympic Games in Barcelona. Based on the magnitude of development index over the entire discussed period of time, a decrease of sports level can be noted. The highest negative index value features the group of Olympic champions. Only within athletes from positions IV-VIII a slight trend of level increase can be observed. The course of the regression line indicates that disproportions between the medalists and other final competitions participants systematically decrease, what proves equalization of the level of the leading athletes in that event (determination coefficient R2=0.142) (Table 1, Fig.1).

Table 1. Results Olympic finals in the years 1968-2012

	Place	1968	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012	GRR
Long jump	I	8,9	8,24	8,35	8,54	8,54	8,72	8,67	8,5	8,55	8,59	8,34	8,31	-0,58
	I-III	8,42	8,15	8,16	8,31	8,34	8,49	8,55	8,34	8,45	8,46	8,26	8,2	-0,24
	IV-VIII	8,03	7,92	7,92	8,09	7,96	7,99	8,03	8,12	8,15	8,25	8,12	8,04	0,11
	I-VIII	8,17	8,01	8,01	8,18	8,1	8,18	8,23	8,2	8,26	8,33	8,17	8,1	-0,08
	%	4,63	2,82	2,94	2,65	4,56	5,89	6,08	2,64	3,55	2,48	1,69	1,95	
High jump	I	2,24	2,23	2,25	2,36	2,35	2,38	2,34	2,39	2,35	2,36	2,36	2,38	0,55
	I-III	2,23	2,22	2,23	2,33	2,33	2,37	2,34	2,37	2,33	2,35	2,35	2,33	0,4
	IV-VIII	2,14	2,16	2,19	2,23	2,29	2,33	2,32	2,31	2,31	2,31	2,29	2,29	0,68
	I-VIII	2,17	2,18	2,2	2,27	2,31	2,35	2,33	2,34	2,32	2,33	2,31	2,31	0,57
	%	4,01	5,41	1,79	4,29	1,72	1,69	0,85	2,53	0,87	1,7	2,55	1,72	
Tiple jump	I	17,39	17,35	17,29	17,35	18,09	17,61	18,17	18,09	17,71	17,79	17,67	17,87	0,25
	I-III	17,29	17,24	17,12	17,27	17,8	17,52	17,71	17,8	17,55	17,61	17,63	17,66	0,19
	IV-VIII	16,97	16,73	16,64	16,61	17,03	17,03	17,16	17,03	17,15	17,2	17,2	17,1	0,07
	I-VIII	17,09	16,92	16,82	16,86	17,32	17,22	17,37	17,32	17,3	17,35	17,36	17,31	0,12
	%	1,85	2,96	2,8	3,82	4,32	2,8	3,11	4,33	2,28	2,33	2,44	3,17	
Pole valut	I	5,4	5,5	5,5	5,78	5,75	5,9	5,8	5,92	5,9	5,95	5,96	5,97	0,91
	I-III	5,4	5,42	5,5	5,69	5,67	5,85	5,78	5,92	5,9	5,9	5,84	5,93	0,85
	IV-VIII	5,29	5,2	5,43	5,54	5,41	5,66	5,58	5,82	5,82	5,74	5,66	5,71	0,7
	I-VIII	5,33	5,28	5,46	5,6	5,51	5,73	5,66	5,86	5,85	5,8	5,73	5,79	0,75
	%	2,04	4,06	1,27	2,64	4,59	3,25	3,46	1,69	1,35	2,71	3,08	3,71	

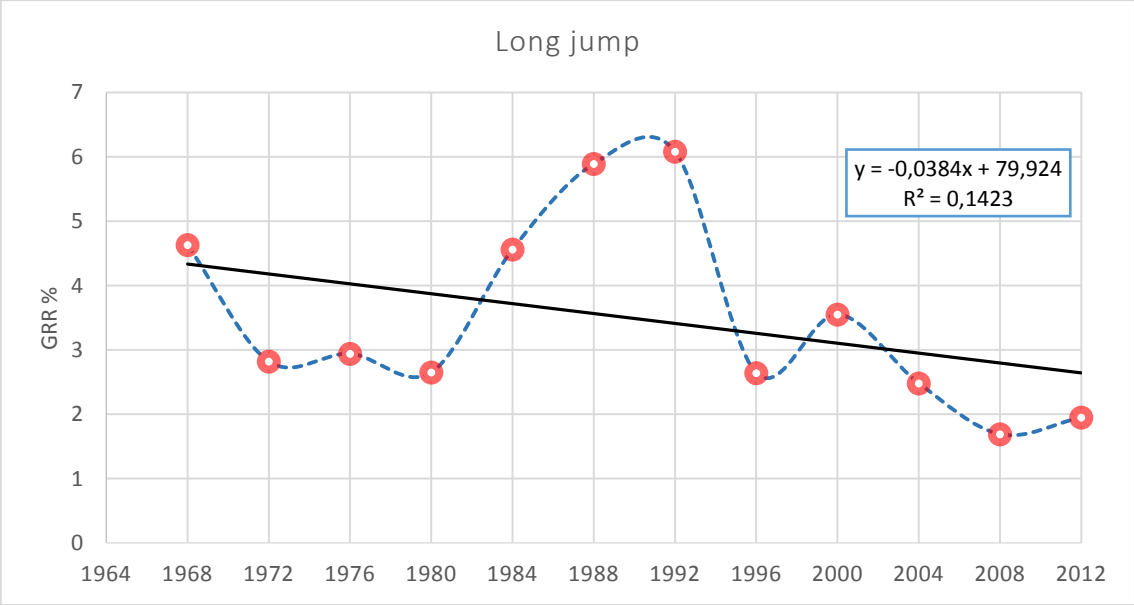

Fig.1. Percentage differences between the long jump results achieved by medalists and athletes from positions 4-8

High jump

Results achieved by Olympic high jump champions in three consecutive competitions are below the 2.30m barrier. That period includes years 1968, 1972, and 1976. At the Olympic Games in Moscow, the winner achieves for the first time result better than the above mentioned barrier (2,36 m). Since then, the result of 2.35 m grants victory in Olympic competitions. The most balanced duel was noted at the Olympic Games in Barcelona, where both the winner and other medalists achieved the same result. The highest sports level was observed at the Olympic Games in Seoul and Atlanta; the average of final results amounted to

2.35 and 2.34 m, respectively. During the period considered, within all analyzed groups of athletes the systematic progress of results is noted.

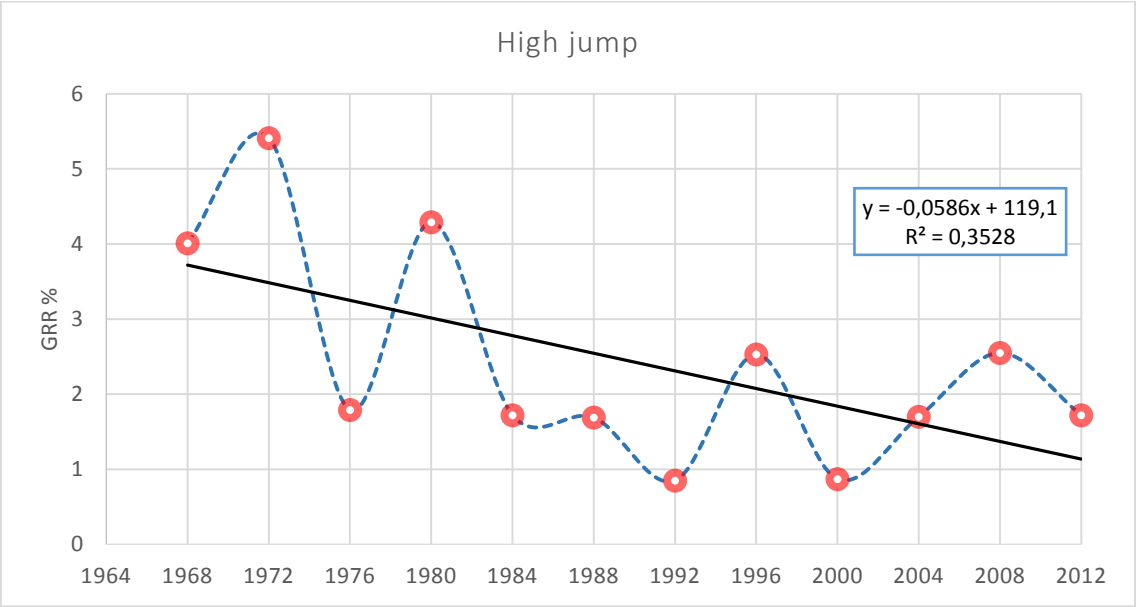

Fig.2. Percentage differences between the high jump results achieved by medalists and athletes from positions 4-8

The highest growth rate was observed in the group of athletes from positions IV-VIII. That can be evidence of the significant sports level equalization of the best high jumpers. Confirmation of that notion is the course of progression lines, from which it follows that differences between the medalists and other participants of final competitions disappear at a rapid pace (Table 1, Fig. 2).

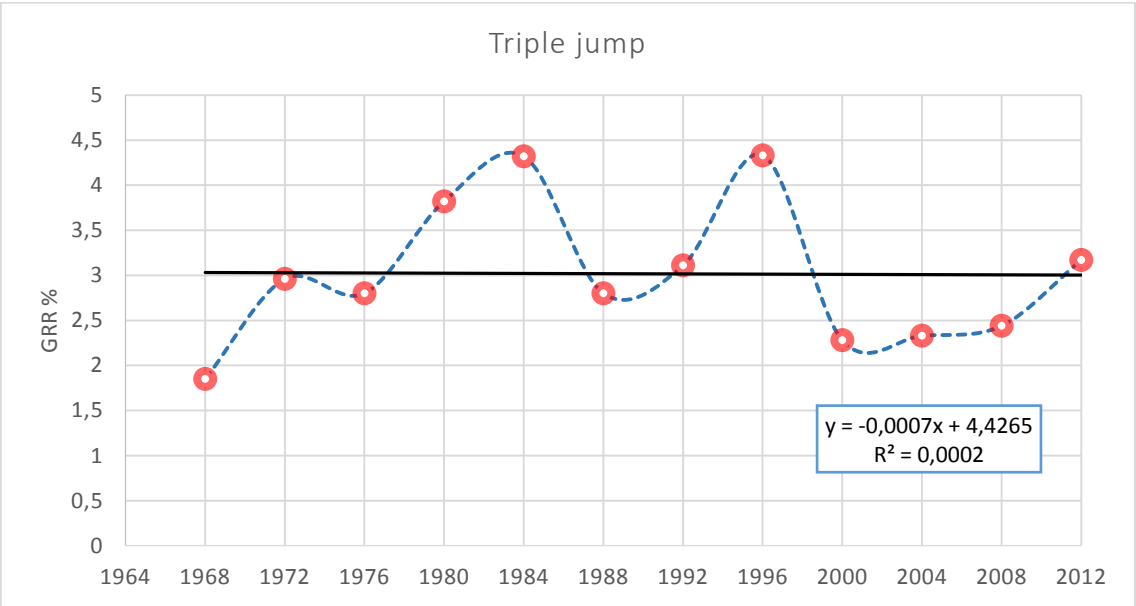

Fig.3. Percentage differences between the triple jump results achieved by medalists and athletes from positions 4-8

Triple jump

The final triple jump competition at the Olympic Games in Mexico (1968) was crucial in terms of achieving results over 17 m. The results achieved as early as in eliminations were better than the then world record and the main competition brought further record improvement. Results achieved both by the winner and other medalists were better than world record and the average result of all final competition participants was at the level of over 17 m. A very balanced level of that competition is confirmed by small disproportions within the range of 2% between medalists and other athletes. In the history of Olympic competitions the winner achieved three times the result over 17 m. That barrier was exceeded for the first time in 1984 at the Olympic Games in Los Angeles (18.09 m), and after that in Barcelona (18.17), and Atlanta (18.09). The competition in Barcelona also featured the highest sports level, what is confirmed by the average result of all participants of that competition (17.37 m). The highest development rate within the period considered features the group of Olympic champions, whereas athletes from positions outside the medal zone feature a low development rate. From the regression analysis it follows, that the distance between the medalists and other athletes from positions IV-VIII remains on a constant level (Table 1, Fig. 3).

Pole vault

Changes in equipment design and regulations concerning that event were the essential factors of pole vault results level increase. Over the entire period considered, the winners of Olympic competitions achieved in principle results at the higher and higher level including the record competition in London in 2012. In that competition, both the Olympic champion and the medalists achieved the best results of all previous finals. The most balanced level feature the finals in Montreal and Sydney; the distance between medalists and athletes from positions IV-VIII does not exceed 1.5%. On the other hand, the greatest disproportions between both groups take place at the Olympic Games in Los Angeles (over 4.5%). The group of Olympic champions features the fastest increase of results. The analysis of regression lines course reveals, that the distance between the leading athletes and other final competitions participants slightly, but systematically widens (Table 1, Fig. 4).

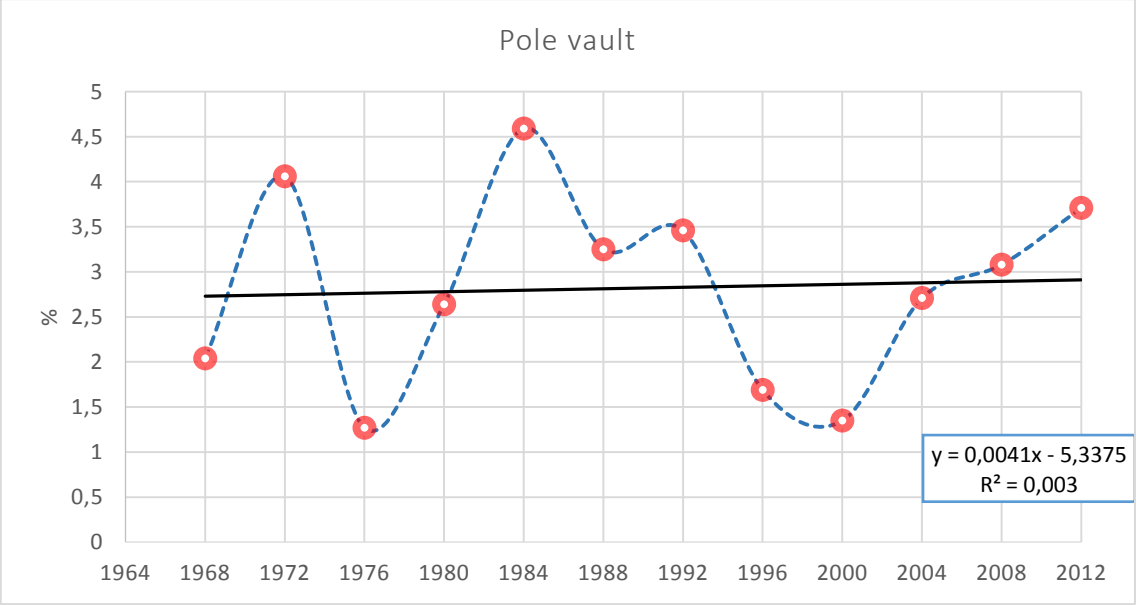

Fig.4. Percentage differences between the pole vault results achieved by medalists and athletes from positions 4-8

The final stage of the analysis is an attempt to find out, which of the events discussed in this study features the highest development coefficient over the examined period of time. In order to determine it, for the four separated groups, i.e. Olympic champions, medalists, athletes from outside the medal zone (IV-VIII), and all finalists, the average growth rate of results between the consecutive Olympic Games was calculated; after that, based on achieved results, the average growth rate within the entire examined period of time was computed.

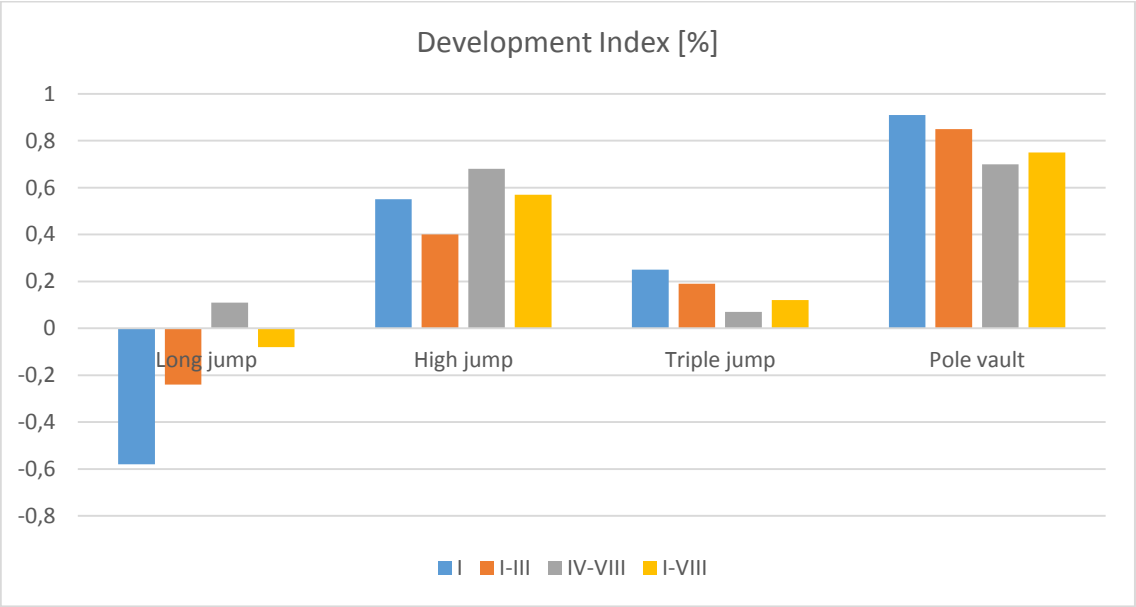

Fig.5. The average men's athletic jumping development index in the respective groups of athletes (in %)

From analysis of those values it follows, that the pole vault, followed by high jump, feature the highest growth dynamics. It involves all analyzed groups. On the other hand, within the examined competitions, long jumpers note regression of results (the worst in the group of gold medalists). Detailed presentation of tendencies discussed above is included in Table 1 and Fig. 5.

CONCLUSIONS

The conducted analysis of results achieved by the finalists of twelve Olympic competitions in four events, i.e. long and high jump, triple jump and pole vault allows for the following conclusions:

1. Over the examined period of time, the pole vault and high jump feature the highest development index of Olympic competitions final results; it concerns all analyzed groups of athletes;
2. Long jump is one of those events that feature a constant decrease of results achieved by the leading athletes – participants of Olympic finals;
3. High jump features the fastest reduction rate of differences between the medalists and other participants of Olympic final competitions.

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