

THE VARIABILITY OF TRACK AND FIELD THROWING EVENTS RESULTS ACHIEVED BY MEN - OLYMPIC FINALISTS FROM 1968 TO 2012

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Abstract:

The purpose of this paper is to analyze the men's track and field throwing results achieved during the final Olympic competitions from 1968 (Mexico) to 2012 (London). The results of champions and Olympic medalists as well as those of athletes taking positions not awarded with medals were taken into account. Percentage disparities dividing the above mentioned groups and present trends in this area throughout the whole researched period of time were determined. The average results of all final competitions participants in individual events were also analyzed. The final result of the analysis is an attempt to define the results development indicators within the particular groups of athletes.

INTRODUCTION

Athletics, as a rational discipline, allows for a quite accurate prediction of future results that can guarantee success in the most important track and field events in the world. The crowning achievement of many years of training efforts is the participation of athletes in the final Olympic competitions and winning an Olympic medal. To achieve Olympic success, the development trends of the particular event should be included in training programs. The research results show that increase of athletic performance in particular track and field events depends on many factors [Maszczyk 2013, Mleczko 2008]. The most important ones include optimization of training loads, improvement of technique and equipment, optimal physiological and biochemical control, adequate diet as well as modern recruitment and selection process.

Olympic men's track and field throwing competitions feature a particular specificity. We know from experience that after anti-doping controls many Olympic medalists were stripped their trophies which were subsequently awarded to athletes finishing in more distant positions.

The track and field throwing events are speed & strength events and athletes practicing them feature meso-endomorphic body type [Maszczyk 2013 Judge in 2004, Paulino et al. 2000, Konz 2006]

In the shot put, at the beginning of the 70s there were attempts to transform the throwing technique from glide to rotational. The application of spin technique made it possible to extend the route and duration of interaction between thrower and equipment and enabled exploitation of morpho-functional features of very tall shot putters with long upper limbs [Zatsiorski 1990, Young and Li 2005, Hubbard et al., 2001]. According to Nowak, the dynamics of result variability in men's shot put shall tend to grow by 12.7% and the borderline result will be at the level of about 26.40m [Nowak, 2007].

In the discus throw, after a very rapid increase in performance in the eighties, there has been a sharp decline in the 90s, caused primarily by increased doping control [Hilton 2004

Clasing 2004 Bowers 2010]. The dynamics of results variability determined by Nowak [2007] shows an upward trend of 16.4%, while the borderline result is at the level of over 87 m.

From the javelin throw data analysis it follows that up to 1985 the men's results tended to increase [Maszczyk 2013]. The changes in equipment design had a huge impact on the throwing technique which resulted in regression in that event [Tidow in 1995, Hatton 2005]. According to Nowak [2007], it can be assumed that the dynamics of results variability will increase by 20.5% and the borderline result will oscillate at a level of over 111 m.

The evolution of hammer throw technique has become an important factor impacting the growth of performance in this event [Dapena et al. 2003, Mercadante et al., 2007]. In the near future, in the dynamics of results variability there will be an upward trend at the level of about 14%, and the borderline result shall exceed 100m [Nowak, 2007].

The aim of this study is an attempt to analyze the results of track and field throwing events achieved by men - finalists of the Olympic Games from 1968 to 2012 and trends present within that period of time.

MATERIALS AND METHODS

Material for this study includes results achieved by Olympic finalists in four men's throwing events, i.e. shot put, javelin throw, discus and hammer throw. Twelve consecutive final competitions, from Olympic Games in Mexico (1968) to Olympics in London (2012) [Iskra 2012], were analyzed. The analysis of the collected material includes results of Olympic champions, the average results achieved by medal winners, the average results achieved by athletes who finished in positions fourth to eight, and the average results achieved by all final competitions participants in individual events. In each event, the percentage rates dividing the medal winners from other athletes were calculated. On this basis, approximated regression lines illustrating the trends occurring in that area were defined. In the final stage of the analysis, the percentage increases of results between the successive Olympic final competitions were calculated for each group of athletes and on that basis the average rate of results development throughout the whole period of time was defined according to the formula [Cieszkowski 2014]:

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

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

RESULTS AND DISCUSSION

Shot put

Shot put is one of strength & speed events. Athletes performing that event feature high height and weight. The analysis of the results achieved during the Olympics showed that the best result was achieved by the Seoul Olympic champion Timmermann (22.47m). At those Olympic Games, the best mean result achieved by medalists and all participants of the final competition (22.28m and 21.24m, respectively) was registered. At the Olympic Games in London (2012) in turn, the athletes ranked on positions fourth to eight featured the best average result (20.87 m) throughout the whole researched period of time. At the Olympic Games in Munich (1972), the final competition in this event proved to be the most balanced, since the difference between medalists and athletes from positions fourth to eight was slightly over 2%. As it follows from the analysis of the results development index, the

highest progression was noted among the finalist competition participants, while Olympic Champions featured the lowest progression (Fig. 1,5, Tab. 1). Based on the analysis of regression coefficient and the course of regression line it can be concluded that that event is characterized by a steady decline of the pace of development.

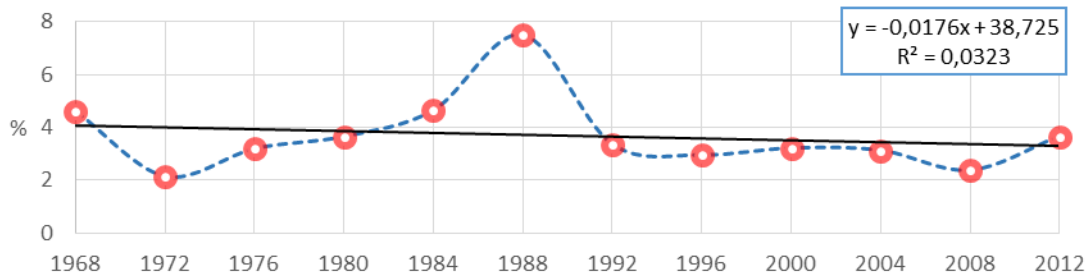


Figure 1. Shot put

Discus throw

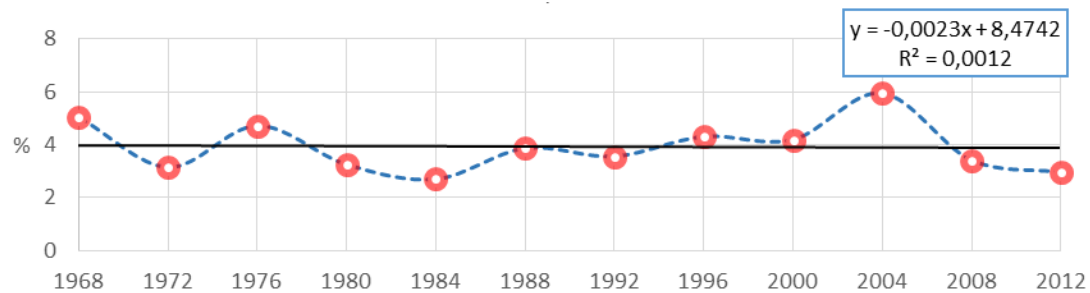


Figure 2. Discus throw

Like shot put, the discus throw is a strength & speed event and the final result is determined by overcoming the force and front resistance as well as by making use of the lift. A very important factor is also the strength and initial velocity of the discus [Cross 2004]. The best result in the final Olympic competition was achieved by Alekna (Athens 2004), while the best average result achieved by medal winners was recorded in Sydney (2000). The final competition at the Olympic Games in London (2012) featured the best average result of all top finalists. Similar situation was noted in case of finalists who did not win medals. Olympic Games in Los Angeles (1984) featured the smallest disparities between medalists and athletes from positions fourth to eight. The analysis of development dynamics indicator shows that the largest progression has been noted in the group of finalists from positions not awarded with medals, while the lowest progression is recorded among Olympic champions (Fig. 2, Tab. 1). The difference between medalists and other final competitions participants is at a constant level of about 4% (Fig. 5)

Javelin throw

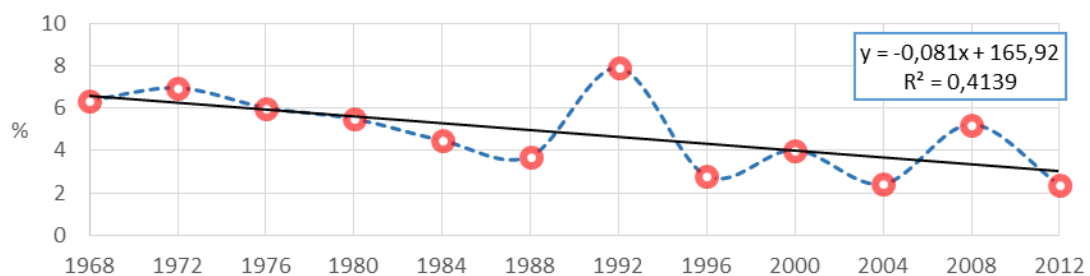


Figure 3. Javelin throw

In this competition, two stages can be distinguished. The first one covers the period until 1984 (old javelin type) and the other one includes the years from 1988 on, i.e. from the Olympic Games in Seoul until now. The dominant role in this event plays the speed and throw technique, while the strength is slightly less important. The best result with "old javelin" was achieved by Nemeth, the Olympic champion from Montreal (1976), and the Olympics in Beijing were the domain of Thorkildsen - Olympic champion using the new type of javelin. The most even competition in this event took place at the Olympics in London (2012). The difference between medal winners and other final competitions participants did not exceed 2.5%. Over the whole examined period of time, a clear trend towards increasing disparity between the medalists and finalists who did not win medals was noted (Fig. 3, Tab. 1) The analysis of the development dynamics indicator shows that in all discussed groups of athletes there has been regression of results achieved in consecutive finals (Fig. 5).

Hammer throw

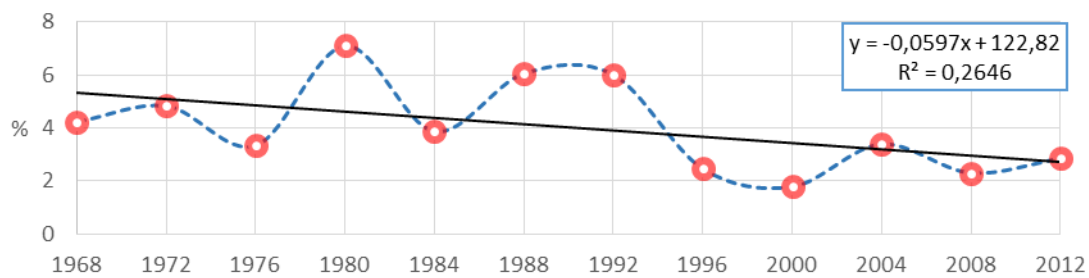
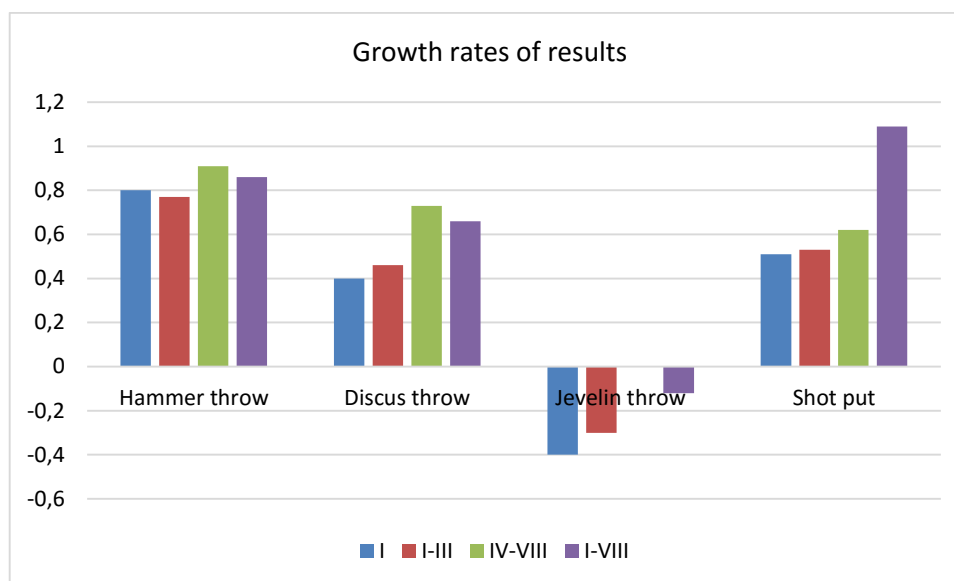


Figure 4. Hammer throw

The decisive element of hammer throw results is rotating motion, during which there is an interaction of body mass and equipment weight. It is a peculiar system, in which the main objective of motor function is to achieve the largest linear velocity in the final stage of throw [Judge in 2004, Mercadante et al., 2007]. The best result in this event was achieved by Litvinov - Olympic champion from 1988. At those Olympic Games, the best average level of medalists' results was recorded. On the other hand, the most even final competition was held in Beijing (2008). Similar situation occurred in the case of athletes from positions fourth to eight. The smallest difference of about 2% between medalists and other final competition participants was recorded at the Olympics in Athens, while the largest difference was recorded in Moscow (over 7%). The group of finalists from positions not awarded with medals features the highest growth dynamics. In general, in that event a constant progress of results in consecutive Olympic final competitions is recorded and the distance separating the medalists from other athletes has a clear regressive character (Fig. 4, Tab. 1).



Rysunek 5. Development index (growth rates of results)

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

Sport	Place	1968	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2012	GRR
Hammer throw	I	73,36	75,50	77,52	81,80	78,08	84,80	82,54	81,24	80,02	82,91	82,02	80,59	0,80
	I-III	72,13	74,83	76,36	80,47	77,58	83,25	81,96	80,79	79,61	80,74	81,71	79,55	0,77
	IV-VIII	69,08	71,22	73,82	74,76	74,58	78,22	77,04	78,80	78,19	78,01	79,83	77,29	0,91
	I-VIII	70,23	72,58	74,77	76,90	75,71	80,10	78,89	79,55	78,72	79,04	80,53	78,14	0,86
	%	4,22	4,82	3,33	7,09	3,86	6,04	6,00	2,46	1,78	3,38	2,30	2,84	-
Discus throw	I	64,78	64,40	67,50	66,64	66,60	68,82	65,12	69,40	69,30	69,89	68,82	68,27	0,40
	I-III	63,59	63,74	66,47	66,45	66,12	67,89	64,73	67,27	68,66	67,86	67,98	68,16	0,46
	IV-VIII	60,41	61,74	63,34	64,30	64,34	65,27	62,43	64,38	65,79	63,83	65,66	66,15	0,73
	I-VIII	61,61	62,51	64,52	65,10	65,01	66,25	63,29	65,46	66,87	65,34	66,53	66,91	0,66
	%	5,03	3,14	4,71	3,24	2,69	3,86	3,55	4,30	4,18	5,94	3,41	2,95	-
Javelin throw	I	90,10	90,48	94,58	91,20	86,76	84,28	89,66	88,16	90,17	86,50	90,57	84,58	-0,40
	I-III	88,58	88,45	89,89	89,19	85,39	83,87	86,55	87,53	89,60	85,43	87,79	84,40	-0,30
	IV-VIII	82,95	82,30	84,49	84,29	81,58	80,75	79,71	85,09	86,00	83,37	83,21	82,38	0,00
	I-VIII	85,06	84,61	86,51	86,13	83,01	81,93	82,27	86,01	87,35	84,14	84,93	83,14	-0,12
	%	6,36	6,95	6,01	5,49	4,46	3,72	7,90	2,79	4,02	2,41	5,22	2,39	-
Shot put	I	20,54	21,18	21,05	21,35	21,26	22,47	21,70	21,62	21,29	21,16	21,51	21,89	0,51
	I-III	20,24	21,16	21,03	21,16	21,11	22,28	21,20	21,05	21,23	21,13	21,22	21,66	0,53
	IV-VIII	19,31	20,71	20,36	20,39	20,13	20,61	20,49	20,43	20,55	20,47	20,72	20,87	0,62
	I-VIII	19,41	20,88	20,61	20,68	20,50	21,24	20,75	20,67	20,81	20,72	20,91	21,17	1,09
	%	4,59	2,13	3,18	3,64	4,64	7,50	3,35	2,94	3,20	3,12	2,36	3,65	-

CONCLUSIONS

The conducted analysis of results allows for drawing the following conclusions:

1. The hammer throw features the biggest indicator of the dynamics of results development in track and field throwing events achieved by male Olympics finalists; this applies both to champions, medalists, and finalists who did not win medals; an exception in this regard is a group of athletes participating in the shot put final competition;
2. The javelin throw is an event, in which within the entire analyzed period of time a regress of results achieved by athletes participating in the Olympic finals can be observed;
3. In all discussed events, a gradual equalization of athletes' sports level is observed; the evidence of that trend are the size of regression coefficient and the course of approximated regression lines.

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