COMPARATIVE ANALYSIS OF BALANCED STATE OF WEIGHTLIFTING RESULTS OF MALE AND FEMALE COMPETITORS AT THE LONDON 2012 OLYMPIC GAMES

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Abstract
The article deals with the comparative statistical analysis of the results of male and female lifters, achieved in London, UK, at the 2012 Olympic Games. It has been established that in case of male weightlifters there are significant differences between the results of different bodyweight categories; the winner of the given category would have been on the average only the 7th in the next, heavier weight category. In general there is a rather high homogeneity within the categories, the performance level of the lifters on the 6th places is only 6.16 % (SD= 2.35 %) less than the results of the gold medalists. On the contrary, in case of female competitors results are not balanced. The no homogeneity is high; there are huge differences between the results of the winners and the others. The gold medalists of the given category would have been still 5th in the next category, and the results level of the lifters on the 6th places is 11.87 % (SD=4.85 %) less than the winning result. The difference between the 6.16 % and the 11.87 % is statistically significant (p=99.9 %).The main reasons of the difference are the following: 1.male weightlifting has a much longer history and higher popularity than female weightlifting; 2.in many countries the level of female weightlifting is rather low; 3.there is a special qualification system for the Olympic games which strongly limits the participation of lifters; 4.the number of male competitors was 149, but the number of female lifters only 103 in London. The performance level is - as an average - 23 % less for female competitors, compared to the results of the male lifters of the same (or similar) bodyweight.

***Keywords**: homogeneity, lifter, performance, statistics, bodyweight categories*

INTRODUCTION

„Man's admiration for great strength will never die. Even in the age of computers and labor-saving machinery man's personal triumphs over gravity thrive as never before in the sport of weightlifting."(Webster,1976). Yes, weightlifting – of course not in the modern form of our times - has always been used for the assessment and proof of physical power since the ancient times. E.g. in the time of Chou Dynasty in China (1122-249 B.C.) potential soldiers had to pass tests of weight-lifting, before they were allowed to enter the armed forces. Not only in China, but in ancient Egypt, the Roman and Greek Empires there were documented traces of an early form of weightlifting (Schödl, 1992). But the renaissance of the development of weightlifting as an individual sport discipline was in the 19th century. Today weightlifting is a modern sport (including 2 disciplines: snatch and clean and jerk), a modern and popular one. The International Weightlifting Federation is the 5th biggest federation of the sport world; it has today 189 member-countries.

The first World Championship was organized in 1891 and weightlifting was included into the program of the first modern Olympic Games in 1896. The International Federation (IWF) was founded in 1905. The sport of weightlifting has gone through tremendous changes in the last decades. One of these significant changes was the introduction of female lifting. The first World Championship for women was organized in 1987, in Florida, USA. Relevant information about the activity of the IWF, the Constitution, Technical and Competition Rules, events, Anti-Doping Policy etc. can be found in the Handbook 2009-2012 (Ajan et al., 2009) and in 'World Weightlifting', which is the official magazine of IWF published, 4 times per year. Updated information on the IWF website: www.iwf.net

Weightlifting – in other words Olympic lifting – is a part of the program of modern Olympic Games to date. The male lifters competed first in Athens, 1896, female lifters for the first time in Sydney, 2000. Although weightlifting is an individual and separate sport discipline, it is much-much more. Weightlifting is the fundament of strength development, base of weight training in other sports as well, and therefore weightlifting is fitness for all other sports (Ajan & Baroga, 1988).

In London the weightlifting competitions were organized between 28. 07. 2012 and 07. 08. 2012 in 15 bodyweight categories, 8 categories for male and 7 categories for female competitors. The 149 male competitors represented 70 countries (NOCs), and the 103 female lifters 57 countries (NOCs). In consequence of a special qualification system – which had a significant impact on the number of participants from the member-countries, being absolutely different from the number of

participants e.g. in world championships - 19 countries won medals and 6 countries gold medals.

ANALYSIS OF THE RESULTS OF MALE LIFTERS

Table 1 shows the analysis of the Olympic total results of male weightlifters. We should mention that there are significant differences between the results of different categories, and the winner of the given category – as an average – would have been only 7th in the next higher category. E.g. the gold medalist of the 85 kg category (Adrian Zielinski from Poland, lifting 385 kg) would have been only 9th in the 94 kg category, where the winning result (Ilya Ilyin from Kazakhstan) was 418 kg.

Table 1. Analysis of the male total weightlifting results in London, 2012,Olympic Games

category	winner	6th place	difference between the 1st and 6th places		place of the winner in the next category
kg	kg	kg	kg	%	
56	293	269	24	8,19	9
62	327	302	25	7,27	6
69	344	325	19	5,52	6
77	379	338	41	10,82	4
85	385	372	13	3,38	9
94	418	397	21	5,02	1
105	412	398	14	3,40	12
+105	455	429	26	5,71	-
average				6,16 (SD= 2,35)	7

There is a rather high level homogeneity (balanced state) within categories, so the categories are quite compact. The performance level of the weightlifters on the 6th places is only 6.16 % (SD= 2.35 %) less than the results of the gold medalists. In general the performance of the silver and bronze medalists is very close to the results of the champions, the difference is insignificant.

ANALYSIS OF THE RESULTS OF FEMALE LIFTERS

In table 2 you can see the analysis of the female weightlifting results in London. The gold medalists lifted significantly more than the others, the performance level of lifters on the 6th places is 11.87 % (SD=4.85 %) less than the results of the winners. This is a huge difference. The gold medalists of the given category – as an average – would have been 5th in the next category. We must mention specially that the winner of the 58 kg category (Li Xueying from China with 246 kg total) would have been 6th even in the 75 kg category. And the 75 kg winner (Svetlana Podobedova from Kazakhstan) would have been 4th with her splendid result (291 kg) even in the superheavyweight (+75 kg) category. It is also typical for the female lifters: in the 75 and +75 kg categories in clean and jerk the lifter placed 6th and below could not even lift the weight that the bests had lifted in snatch.

Table 2 Analysis of the female total weightlifting results in London, 2012 Olympic Games.

category	winner	6th place	difference between the 1st and 6th places		place of the winner in the next category
kg	kg	kg	kg	%	
48	205	176	29	14,15	5
53	226	196	30	13,27	9
58	246	231	15	6,10	1
63	245	224	21	8,57	7
69	261	246	15	5,75	5
75	291	246	45	15,46	4
+75	333	267	66	19,82	-
average				11,87 (SD= 4,85)	5

So in case of female weightlifters there is a high level of non homogeneity, the performance decrease is significant in case of the other participants of the categories, compared to the winning results. The categories are not compact. In general there are significant differences also between the results of Olympic champions and the other medalists.

COMPARISON OF THE MALE AND FEMALE RESULTS

The difference between the 6.16% and 11.87% seems to be significant. A statistical analysis was carried out for the determination of the level of significance (table 3.) On the base of the results of Table 3 we can establish that the difference is significant even on the 99.9% level of significance, so the probability of error is less than 0.1 %. Let us mention that the conclusion was similar to the analysis of the 2000 Sydney Olympic Games results, where the difference was 5.5 % for the male and 11.6 % for the female competitors (Szabo, 2000).

Table 3 Analysis of the level of significance in case of FG = 8 + 7 - 2 =13

Statistical determination of t-value:

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{(n-1)s_x^2 + (m-1)s_y^2}} \times \sqrt{\frac{nm(n+m-2)}{n+m}}$$

Where:

- $\bar{x}$ average of the values of the first group
- $\bar{y}$ average of the values of the second group
- s_x SD value of the first group
- s_y SD value of the second group
- n number of elements in the first group
- m number of elements in the second group

p significance	0,05	0,01	0,001
critical t-values at	1,771	2,650	3,852
calculated t-value	4,216		

Table 4 deals with the comparison of the winning results of the same (or similar) categories of male and female lifters, as produced in London. Taking into account the differences in 5 categories the average difference is 84.4 kg, which is 23.0 % (SD=3.7 %). So, having the same bodyweight the best female lifters perform approximately 20-25 % less in total than the male lifters. This difference is based on the anthropometrical, biomechanical and body composition differences between the 2 genders (Spassov, 1986). Of course the training with female competitors needs a special consideration and coaching attitude (Feher, 2006). But, because of the fact that the history of female lifting is much shorter, and still the popularity is also significantly lower than in case of male weightlifting, this 23 % difference will probably decrease during the next decades of weightlifting sport.

Table 4. Performance (kg) difference between the male and female results with the same (or similar) bodyweight

male lifters		female lifters		difference	
category	total	category	total	kg	%
56	293	58	246	47	16,0
62	327	63	245	82	25,1
69	344	69	261	83	24,1
77	379	75	291	88	23,2
+105	455	+75	333	122	26,8
average				84,4	23,0 (SD= 3,7)

It is necessary to mention that in case of top male strength athletes (including lifters, where the dynamic and maximum strength is of primary importance) the development of world record results can be characterized by a saturation type curve, so no or only very limited development. In weightlifting the best results were achieved mainly in the '80s of the 20th century. Let us mention that e.g. compared to what Turkish lifter Naim Suleymanoglu lifted in clean and jerk (190 kg in the 60 kg category) in 1988, today even the best 62 kg lifters cannot lift more than 180 kg. Or the Bulgarian Asen Zlatev lifted 225 kg in clean and jerk in the 82.5

kg category in 1986, and today the best 85 kg lifters achieve only 215 kg. Or the biggest weight in the history of weightlifting was performed by Belorussian competitor Leonid Taranenko in the superheavyweight category: 266 kg clean and jerk in 1988, and today the best weightlifters lift approximately 250 kg. But in case of female lifting the development is still significant, every year new and new world records are added. The results in female lifting today have much higher level than 15-20 years ago.

CONCLUSIONS

Analyzing the results of the weightlifting competitions in London – investigation of the homogeneity / non homogeneity of performance levels within categories - it has been established that in case of male weightlifters there are significant differences between the results of different categories. In consequence of this fact the winner of the given category would have been as an average only the 7th in the next, heavier bodyweight category. In general there is a rather high homogeneity within the categories, the performance level of the lifters, placed 6th in the competition is only 6.16 % (SD= 2.35 %) less than the results of the gold medalists.

On the contrary, in case of female competitors there are no well balanced results. The non homogeneity is high; there are huge differences between the results of the winners and the others. The gold medalists of the given category would have been 5th in the next category, and the results level of the lifters on the 6th places is 11.87 % (SD=4.85 %) less, than the winning result.

The mathematical analysis proved that this huge difference between the 6.16 % and the 11.87 % is statistically significant (p=99.9 %).

The main reasons of the significant difference are the following:

1. male lifting has a much longer history and popularity than female weightlifting
2. in many countries the level of female lifting is still rather low
3. there is a special qualification system for the Olympic Games which limits participation
4. the number of male competitors was 149, but the number of female lifters only 103

The performance level is 20-25 % less for female competitors, compared to the results of the male lifters of same (or similar) bodyweight. The development of the world records of the lifting results was tremendous in case of female weightlifting, but this is not typical for male weightlifting, where the best results were achieved in the '80s of the previous century.

REFERENCES

1. Ajan, T., S. Coffa, A. Nemeth-Mora, A. Adamfi, M. Ungar, R. Nagy (eds.) (2009). IWF Handbook 2009-2012. IWF, Budapest.
2. Ajan, T., Baroga, L. (1988). Weightlifting, fitness for all sports. IWF, Budapest, Medicina.
3. Feher, T.(2006). Characteristics of female weightlifting. In: Olympic weightlifting, Strength Sport Libri Publishing House, p. 295-305.
4. Schödl, G. (1992). The lost past. A story of the International Weightlifting Federation. IWF, Budapest, Gutenberg Ltd.
5. Spassov, A. (1986). The influence of weightlifting on the woman's body. World Weightlifting, 44-48, 1986(3).
6. Szabo, A.S. (2000). Comparative analysis of the results of weightlifting competitions on the 2000 Olympic Games. Hung. Review of Sport Science, 2000(3-4), 11-12.
7. Webster, D. (1976). The Iron Game. An illustrated history of weight-lifting. John Geddes Printers, Irvine, Great Britain, 1976.

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