Original Article

Starting grade as a factor of success in the beam discipline in gymnastics

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Abstract

The aim of the research was to examine the initial grades of gymnasts who participated in the finals in the balance beam discipline at the World Cup in Doha. The hypothesis of this research should show that the initial grade has a large share in the success when performing the composition on the beam. The sample of participants consists of eight gymnasts who qualified for the final in the beam discipline at the FIG World Cup Series competition - Doha (Qatar) in 2022. These gymnasts come from six national federations, which are shown with their starting grades, errors in performance, final grades and placement. In this case study, the research shows that the performance of gymnasts at the top level is very safe, because the finalists on beam did not make major mistakes, they fulfilled all specific requirements and some achieved bonus elements.

1. Introduction

The analysis of competitive achievement should contain several areas that are directly involved in the physical and technical preparation of athletes (Ilić et al.,

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2023; Kahrović et al., 2023). The objective factors that are present in the training process of top athletes must be according to the standards of the International Federations that have prescribed the rules in the competition hall, and these rules are applied in all sports disciplines, including in gymnastics training centers (Mekić et al., 2022a; Potop, Grigore, & Moraru, 2014). The schedule of disciplines with prescribed mats for vaulting and vaulting, landings, gymnastic podium and other gymnastic exercises are designed with the aim of providing optimal conditions for gymnasts in the training process. Achieving top sports results requires an analysis of sports movements. ie analysis of the success of the sports achievement of mastered exercises (Bussey, 2013). Bussey (2013) in order to improve the technique of performing some, in our case, gymnastic exercise, it is necessary to have some model characteristic or personality with which it is necessary to compare the current level of mastered technique and its execution. In order to improve the technique of performing an exercise, a qualitative analysis is generally used, which is more often used by teachers, coaches and sports analysts when working with individual athletes or teams. Qualitative analysis is based on real-time or video observation. This analysis is based on comparing the performance of the performance technique of a sports movement, but it is usually based on determining whether the performance technique has been correctly adopted. It must be used with a biomechanical analysis, which should reveal potential errors in performing the technique of a sports movement in order to remove barriers to sports progress (Farana et al., 2023).

One of such complex sports, which is based on the correct technique of performing exercises in teams in individual disciplines, is gymnastics. Sports gymnastics as an individual polystructural conventional sport (Mekić et al., 2022b; Hart, Bauer, & Bae, 2024) rests on the model characteristics of accurately and precisely executed movement technique of gymnastic exercises. Polystructurality in sports gymnastics indicates that it is a sport that contains various forms of cyclic and acyclic movement, and conventionality indicates that all exercises should be performed according to a precisely determined model of movement technique, which is also called the "ideal model" of movement (Albright, Meghani, Lemme, Owens, & Tabaddor, 2023). Progression in gymnastic exercises is achieved according to the development program proposed by the experts of the Fédération Internationale de Gymnastique (FIG) in the field of men's, women's, rhythmic, aerobic gymnastics as well as acrobatics, trampoline and parkour and can be found on the official website of the FIG (age group programme 2021). In women's sports gymnastics, the smallest movement structures are exercises interconnected in a gymnastic composition that are evaluated at gymnastics competitions (Fink, 2023). The evaluation or assessment of the achievements of those gymnastic teams is done by the judges, who find mistakes in the performance of the movement technique. Mistakes are evaluated based on subjective observations that have objective rules defined by the Evaluation Rules. The grading model provided by the FIG Rulebook (2022-2024) refers to the realization model of success, and any deviation from that model is penalized by a certain number of points, which is defined as an aesthetic

or technical error when performing a gymnastic exercise.

Prassas, Kwon, & Sands (2006) analyzed previous research on biomechanical parameters in sports gymnastics. The authors believe that this type of research helps in explaining the existing technique of gymnastic exercises and that it helps in learning new exercises. In this research, the beam discipline research included the reaction forces at the reflection for the jump from the beam, the angular velocity of the jump and a comparative analysis of the parameters for the technique of performing acrobatic exercises. Potop et al. (2022) are focused on the analysis of biomechanical characteristics related to jumping from the beam. Research has confirmed that the surface used when landing from the beam is very important for gymnasts. Pérez-Soriano et al. (2010) investigated the correlation between the plantar pressures of gymnasts' feet on different landing surfaces. They found a significant correlation between the lateral and medial metatarsal zones of the foot during landing.

Beam is a specific discipline that requires gymnasts to perform dance and acrobatic elements linked by a unique choreography (Schärer, Reinhart, & Hübner, 2023). In addition to the correct technique of performing the exercises, the gymnast must also show her personal style, which shows her creativity and personal style, which is evaluated as an arististic performance. The content of the gymnastic composition on the beam should include the 8 most difficult elements that count as weights (Mekić et al., 2022b). The compositional requirements on the beam are described in the following Table 1.

Table 1. *Compositional requirements on beam according to the 2022-2024 evaluation rulebook*

Require ments	Description of the compositional requirements of the FIG (2022-2024)	Number of points
1.	One connection of at least two different dance elements (exercises) one of which is a jump with a spread of 1.800. performed in the frontal or lateral plane or by removal;	0.50
2.	A turn from Group 3 from the Table in the Evaluation Rulebook or a "Thomas" wheel/wheel. Turns must be performed on the beam if recognized as a specific requirement. Reels may only be used to fulfill this requirement. the so-called "Thomas" cars are exercises numbered 1.303. 1.403.....5.505;	0.50
3.	One acrobatic series of at least two exercises that must be with a flight phase with or without arm support and one exercise must be a somersault where the exercises can be the same in the series;	0.50
4.	Acrobatic elements (exercises) performed in different directions whereby they can be performed forward or laterally and backward.	0.50

The problem of the research is the analysis of the initial grades of the gymnasts participating in the final in the beam discipline, which was set as one of the reasons for the competitive success. Therefore, the aim of the research was to examine the initial grades of gymnasts who participated in the finals in the balance beam discipline at the World Cup in Doha. The hypothesis of this research should show that the initial grade has a large share in the success when performing the composition on the beam.

2. Material and methods

For the analysis of the elements shown in the initial assessment of the gymnasts in this research, we decided on the beam discipline at the FIG World Cup Series competition - Doha (Qatar) in 2022. This World Cup in Doha is organized every year under the auspices of the FIG and the Qatar National Gymnastics Federation. The reason for choosing this year's competition is the changes and additions to the referee's rules that followed this year. The final of the World Cup in Doha 2022 was downloaded for analysis from the site: https://www.youtube.com/watch?v=usv4t6uhL6s.

Participants

The sample of participants consists of eight gymnasts from the World Cup in Doha (Qatar) who qualified for the final in the beam discipline. These gymnasts come from six national federations, which are shown with their starting grades, errors in performance, final grades and placement in Table 2.

Table 2. *Participants in the WC Doha 2022 beam final*

	GYMNAST	NATIONALITY	DIFFICULTY	EXECUTION	SCORE	RANK
1.	Lucia Hribar	SLO	4.7	7.100	11.800	6
2.	Wong Hin Ying	HKG	4.8	7.533	12.333	3
3.	Tjasa Kysselef	SLO	4.2	7.00	11.200	7
4.	Korkem Yerbossynkyzy	KAZ	5.0	6.866	11.866	5
5.	Nora Peresztegi	HUN	4.8	7.933	12.733	2
6.	Vladislava Urazova	RUS	5.0	8.200	13.200	1
7.	Anastasiya Smantsar	BLR	5.0	7.066	12.066	4
8.	Csenge Maria Bacskay	HUN	4.4	6.733	11.133	8

Sample of variables

The sample of variables in this research consists of seven criteria that determine the weights of the compositional requirements and bonus elements on

beam, which are described in Table 3.

How is the analysis of the gymnastic composition from the aspect of the weight values of the compositional requirements and bonus elements based on the initial assessment and expert record of exercises with symbols specific requirements can also be determined. In the analyzed exercises, the gymnasts performed weights of 0.10-0.50, having fulfilled three or four compositional requirements: the bonus elements were achieved by only one gymnast (Table 3).

Statistical analysis

The data obtained by the previously described procedure was processed with the SPSS 20 statistics program (Statistical Package for Social Sciences, v20.0, SPSS Inc., Chicago, IL, USA).

The parameters to be calculated are descriptive statistics parameters (basic central and dispersion parameters that make up the final evaluation of gymnasts in the beam discipline); Correlation parameters, which determine the strength and direction of the linear relationship between two variables. In this study, we opted for the Spearman rank correlation coefficient, because this coefficient is suitable for quantities that can be ranked and is especially useful when the data do not meet the criteria for the Pearson coefficient (Pallant, 2011).

3. Results and Discussions

Based on the expert record of judges of national rank an analysis of the starting grade of the gymnasts was performed whose values are evaluated and displayed on the official screen and in the bulletin. Based on the criteria of the Judiciary Commission that assessed at the WC Doha. Those values are shown in Table 3.

Table 3. *Elements of initial assessment*

	GYMNAST	NAT	DIFF	A	B	C	D	E	F	G
1.	L. Hribar	SLO	4.7	1	1	2	4	-	4	/
2.	WH Ying	HKG	4.8	/	1	4	2	1	4	0.10
3.	T. Kysselef	SLO	4.2	/	1	3	4	/	3	/
4.	K. Yerbossynkyzy	KAZ	5.0	/	/	3	4	1	4	/
5.	N. Peresztegi	HUN	4.8	/	/	5	2	1	4	/
6.	V. Urazova	RUS	5.0	/	2	3	3	1	4	/
7.	A. Smantsar	BLR	5.0	/	1	2	3	2	4	/
8.	C.M. Bacskaya	HUN	4.4	1	1	3	3	/	4	/

Descriptive statistics is the first step in data analysis. Hypothesis testing involves the calculation of descriptive statistical variables, which results in certain information (Pallant, 2011). The interpretation of the results usually begins with the calculation of the measure of the mean value and the measure of dispersion of individual variables.

The most commonly used measure of mean value is the mean. Table 4 shows the parameters of the descriptive statistics of the initial grades of gymnasts participating in the World Cup in Doha in 2022.

Table 4. *Descriptive statistics of the initial grades of gymnasts*

Variables	Mean	St. Dev.	Skewness	Kurtosis
Difficulty	4.737	0.297	-1.008	-0.042
Execution	7.303	0.529	0.850	-0.696
Score	12.041	0.709	0.291	-0.549
Rank	4.50	2.449	0.000	-1.200

Table 5 shows the parameters of the correlation of the initial grades of gymnasts participating in the World Cup in Doha in 2022.

Table 5. *Spearman's correlation coefficient of the initial grades of gymnasts*

	Execution	SCORE	RANK	A weight	B weight	C weight	D weight	E weight
Difficulty	0.356	0.700	-0.700	-0.520	-0.035	-0.079	-0.195	.874**
Sig.	0.387	0.053	0.053	0.187	0.934	0.852	0.644	0.005
Execution		.881**	-.881**	-0.378	0.289	0.319	-0.517	0.378
Sig.		0.004	0.004	0.356	0.488	0.441	0.190	0.356
SCORE			-1.00**	-0.630	0.096	0.396	-0.592	.717*
Sig.				0.094	0.821	0.332	0.122	0.045
RANK				0.630	-0.096	-0.396	0.592	-.717*
Sig.				0.094	0.821	0.332	0.122	0.045
A weight					0.145	-0.405	0.267	-0.690
Sig.					0.731	0.319	0.523	0.058
B weight						-0.361	0.007	-0.120
Sig.						0.379	0.986	0.776
C weight							-0.649	0.084
Sig.							0.082	0.843
D weight								-0.469
Sig. (2-tailed)								0.241

* Correlation is significant at the $p < 0.05$ level (2-tailed)
** Correlation is significant at the $p < 0.01$ level (2-tailed)

Discussions

In Table 4 it can be seen that the mean value of the starting grades of gymnasts at the World Cup in Doha in 2022 in beam performance is 4.737 and the average performance is 7.303. Based on the values of the initial grades, it can be concluded that the criterion of the weights shown by the gymnasts is high. Based on the grade E of the judging panel, it can be concluded that there were no major mistakes in the performance of the gymnasts, because this grade also includes a deduction for artistry, which on beam can be up to 1.20 points.

Table 5 shows the parameters of the correlation of the initial grades of gymnasts participating in the World Cup in Doha in 2022. The size of the correlation is shown by Spearman's correlation coefficient, which shows that there is a high correlation between the values of weight and final grade (0.053), as well as weight and final placement of gymnasts (0.053) at a significance level of ($p<0.05$). Performance is directly correlated with the final grade (0.004) and the final placement of the gymnasts (0.004) at a significance level of ($p<0.01$). This high correlation is expected because the higher the starting score of the gymnasts and the good performance on beam (which implies performance without major technical and aesthetic errors), the higher the possibility of a better placement. The starting grade is directly correlated with the final ranking (0.000) and represents the expected interpretation only if the performance of the gymnasts is without major technical and aesthetic errors, which is also the case in this research. In this table, there is a connection and statistical significance between the weight value and "E" weight, which has a value of 0.5 points, which can be explained that if a gymnast has as many weights as possible with a higher number of points in her composition, e.g. D weight has a value of 0.4 points, F weight 0.6 points, G weight 0.7 points, the total weight value is higher with the performance of elements with a higher weight composition.

4. Conclusions

Success in sports gymnastics is defined as the ability to perform exercises of high weight with a high result. Successful performance in sports gymnastics is the result of the interaction of many factors that are difficult to differentiate. In this study, the research shows that the performance of gymnasts at the top level is very safe, because the finalists on beam did not make major mistakes, they fulfilled all specific requirements and some achieved bonus elements. According to the classification of gymnasts, it is observed that the differences between them are very small (0.50-2.00), which is attributed to the high automation of movements when performing high weight requirements, which results in a better final grade. The hypothesis of this research proved that the starting grade has a large share in the final placement (0.004) when performing the composition at beam.

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