APPARATUS DIFFICULTY IN RHYTHMIC GYMNASTICS ROUTINES – COMPARISON BETWEEN 2 OLYMPIC CYCLES

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Original article

Abstract

The aim of this study was to analyze the evolution of the apparatus difficulty in Rhythmic Gymnastics gymnasts in 2 Olympic cycles and identify eventual factors that could contribute to improve the performance quality in competition. We studied the value of the apparatus difficulty in the gymnasts (potentially the gymnasts could participate in the Olympic Games) of the first World Championships of each cycle (2012/2016 e 2016/2020). This analysis focused on the technical value of the apparatus difficulty performed by the gymnasts in a total of 288 competition routines in the World Championships 2013, and 200 competition routines in the World Championships 2017. The data was treated using the descriptive statistics and after checking the normality of the data distribution using the Kolmogorov-Smirnov test we used a t-test to determine whether there were significant differences between the World Championships. Results showed an increasing appreciation of the apparatus difficulty in the final score of the gymnasts. The apparatus difficulty elements were significantly increased from one cycle to the other, mainly due to the increase of the Mastery value. There's a greater balance in the use of different elements, giving privilege to the apparatus technique. The increase on the value of the apparatus difficulty in the RG competition routines will contribute for the quality and diversity of the RG competition in the Olympic Games.

Key words: *Rhythmic Gymnastics, Apparatus difficulty, Evaluation, Competition performance.*

INTRODUCTION

The Olympic competition is, for all participants the highest level of excellence in each sport. It is also the turning point for the new Olympic Cycle. In the beginning of each Olympic Cycle the International Gymnastics Federation (FIG) rhythmic Gymnastics Technical Committee presents the updates to the code of points in order to promote sports evolution, (Čuk, Fink, & Leskošek, 2012), through the increase of the complexity of the body and apparatus skills. In the present Olympic cycle, the most part of the changes in the Code of Points (CoP) were focused in the evaluation of the difficulty. The changes were related not only with the organization of the evaluation panel but also with the evaluation criteria. These changes and different implications in the way the routines are composed and of course in the training process. The skilful interaction between the gymnast and the apparatus and the increase difficulty

elements in the routines composition are the development in rhythmic gymnastics (RG), (Lebre, 2011).

Nowadays, the evaluation of individual routines of rhythmic gymnastics considers two main components, Difficulty and Execution. To evaluate these two components, as stated in the COP, the panel of judges must be formed by 10 judges, where 4 evaluate the Difficulty component and 6 evaluate the Execution component. In each of these judge groups there's a subdivision of tasks. In the evaluation of Difficulty (D), the judges D1 and D2 evaluate the number and value of the Body difficulties (BD), dance steps (s) and number of fundamental apparatus elements) and the judges D3 and D4 evaluate the number and value of the Dynamic Elements with Rotation (DER) and apparatus difficulties (AD). In the evaluation of Execution (E), the judges E1 and E2 evaluate the artistic component (Unity of composition, Music and Movement, Body expression and variety), and the judges E3, E4, E5 and E6 evaluate the technical faults (all technical deviations from correct performance), (FIG,2016). This structure of evaluation, with significant changes to the structure that guided the evaluation of competition in the previous Olympic cycle (2012/2016), leads to the necessity of reflect on and analyse the effects of its application.

In order to evaluate the magnitude of these changes, which happen in the beginning of each olympic cycle, is important to quantify them in the first World Championship of the Cycle.

Doing this evaluation in the first main competition of the cycle, we can use data in real time to allow coaches to adapt their training process to the last World Championship of the cycle where takes place the qualification process to the following Olympic Games.

Therefore, the aim of this study was to evaluate the differences registered in the first RG World Championship of 2 Olympic cycles, World Championships, Kiev 2013 (2013WCh) and World Championships, Pesaro 2017 (2017WCh). We focused our attention in the analysis of the changes in the Apparatus Difficulty due to the great amount of changes registered in the 2016 FIG CoP (FIG, 2016).

METHODS

Subjects and design

A total of 288 competition routines in the World Championships 2013, and 200 competition routines in the World Championships 2017, were analysed according to the concerned Code of Point rules (FIG, 2012; FIG, 2017).

All routines were analysed in video by three international RG judges. The RG judges observed each routine once and at the same time. The intraclass correlation coefficient (ICC) in test-retest method (intra-examiner) was 0.99. The ICC between the observers (inter-examiner) was 0.98.

Statistical Analysis

For the statistical analysis we used the Statistical Package for the Social Sciences - Version 17.0 (SPSS 17.0, Chicago, USA) and Microsoft Office Excel 2007. Descriptive statistics were calculated using the mean values as a measure of central tendency, standard deviation (sd) as a measure of dispersion, and minimum and maximum as measures of data range. After checking the normality of the data distribution using the Kolmogorov-Smirnov test we used a t-test to determine whether there were significant differences between 2013WCh (n=288) and 2017WCh (n=200) ranking. The routines were also analysed by apparatus Hoop, Ball, Clubs and Ribbon, to determine whether there were significant differences between 2013WCh (n=72) and 2017WCh (n=50) in each apparatus. A α level less than 0.05 was used as a criterion for significance.

RESULTS

We compare routines difficulty value of the 2 competitions (2013WCh and 2017WCh). In the table 1, we summarize the results all routines (global) and by apparatus, for the total difficulty value and

for the body and apparatus difficulty separately.

Table 1
Body, Apparatus and Total difficulty value of the routines presented in the RG World Championships 2013 and 2017.

	Hoop		**Ball**		**Ribbon**		**Clubs**		**Global**	
VALUE	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50
Body Difficulty	4,59	3,13	4,67	3,24	4,89	3,33	4,94	3,41	4,7725	3,2775
Apparatus Difficulty	1,85	2,95	1,89	2,91	1,56	2,82	1,36	2	1,665	2,67
Total Difficulty	6,44	6,08	6,56	6,15	6,45	6,15	6,3	5,41	6,4375	5,9475

There are considerable differences between the results found in the 2 World Championships. Is visible an inversion on the importance each component of the total difficulty value. The Apparatus Difficulty values show more importance to achieve the final score in the 2017WCh than in the 2013WCh. For all apparatus we remarked a decrease in the Body Difficulty value and an increase of Apparatus Difficulty value. When we consider the values globally for all apparatus, we found statistically significant differences between these results, visible in the Figure 1.

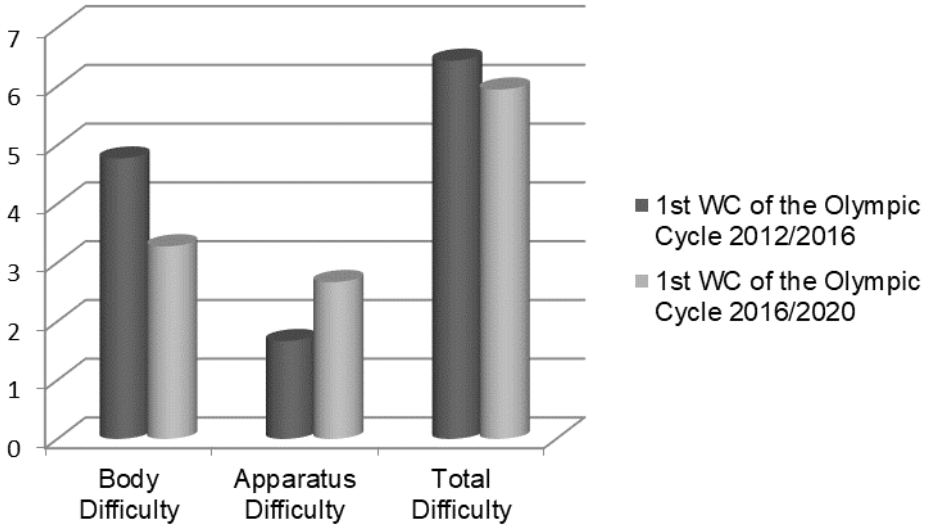

Figure 1. Comparison between the Body, Apparatus and Total difficulty values of the routines presented in the RG World Championships 2013 and 2017. (*p<0.05).

We analysed the difficulty value of the 2 components of the Apparatus Difficulty (Mastery/AD and DER) in all routines (global) and by apparatus (Hoop, Ball, Clubs and Ribbon) performed in both World Championships (Table 2).

Table 2
Apparatus difficulty components value, of the routines presented in the RG World Championships 2013 and 2017.

	Hoop		Ball		Ribbon		Clubs		Global	
VALUE	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50	WCh 2013 n=72	WCh 2017 n=50
Mastery/AD	0,39	1,23	0,6	1,66	0,23	1,2	0,24	0,82	0,37	1,23
DER	1,46	1,72	1,29	1,25	1,33	1,62	1,12	1,18	1,3	1,4425

As we can see in Table 2, is clear a high increase of the Mastery/AD value from the 2013WCh to the 2017WCh. Statistically significant differences between the value of Mastery/AD registered in both World Championships were found (Figure 2).

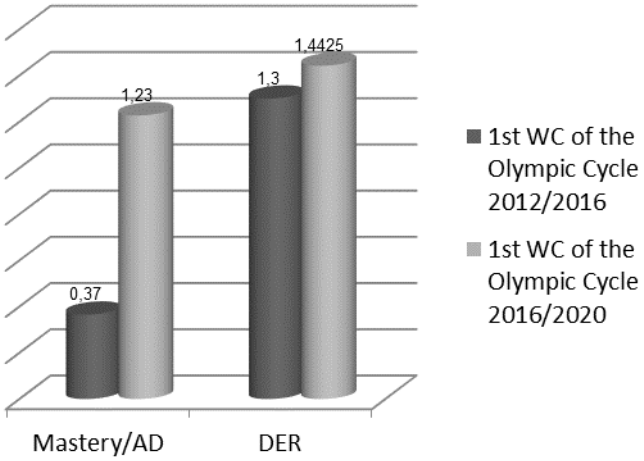

Figure 2. Comparison between the Mastery/AD and DER values of the routines presented in the RG World Championships 2013 and 2017. (*p<0.05).

In the Figure 3 it can be observed the contribution (in percentage) of the body and Apparatus Difficulty (Mastery/AD + DER) for the total difficulty value in the 2013WCh and the 2017WCh.

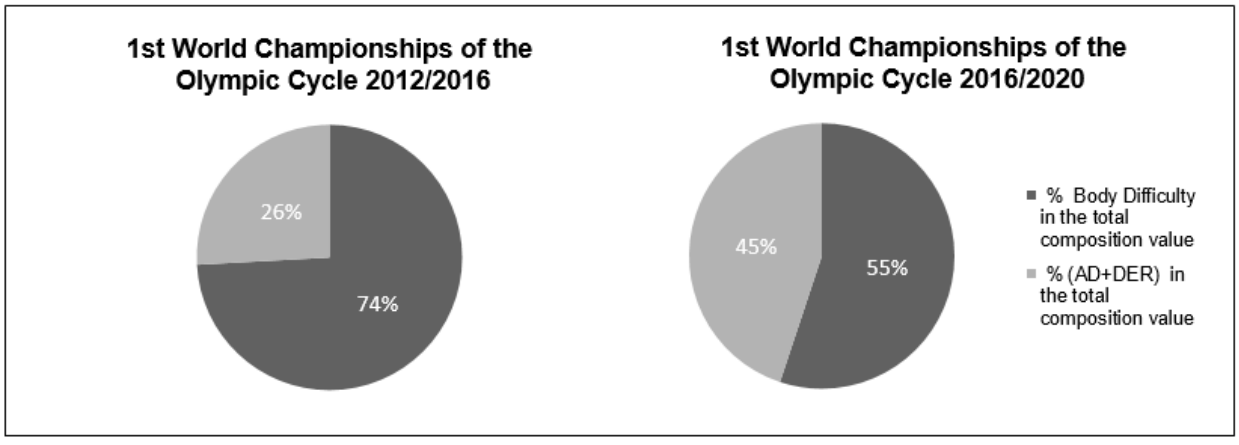

Figure 3. Percentage of Body and Apparatus difficulties value, of the routines presented in the RG World Championships 2013 and 2017.

We can see that the contribution of the 2 components for the total difficulty value are clearly more balanced in the present Olympic cycle (45% - 55% in the present cycle against 26% - 74% in the past cycle).

The possibilities of usage for the apparatus (mastery or DER) are shown on Figure 4.

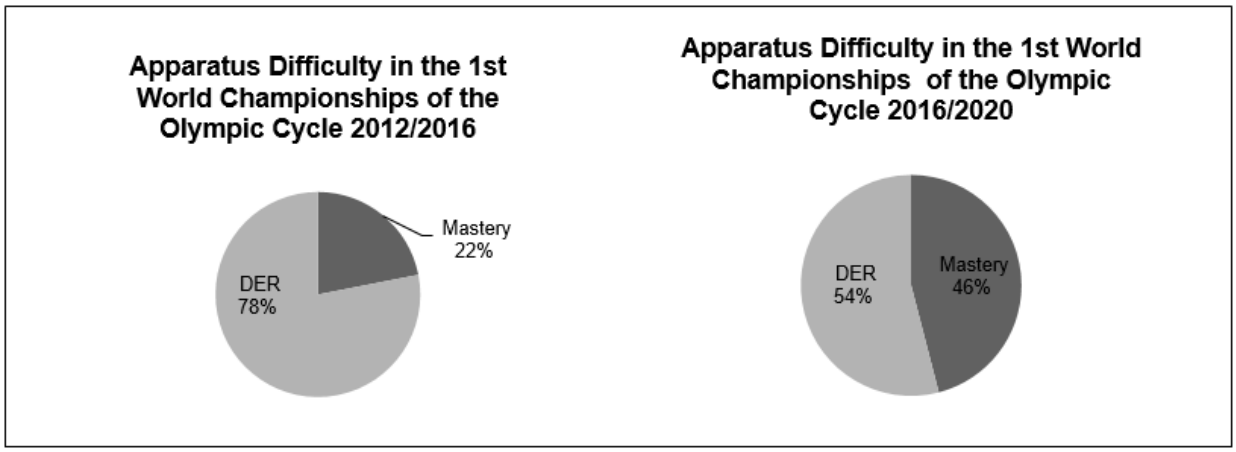

Figure 4. Percentage of apparatus difficulty components value, of the routines presented in the RG World Championships 2013 and 2017.

Analysing the Apparatus Difficulty, we could see that the Mastery/AD registered a visible increase from the 2013WCh to 2017WCh. The distribution of Apparatus Difficulty components is much more balanced in the 2017WCh (54% DER and 46% Mastery/AD) than in the 2013WCh (78% DER and 22% Mastery/AD).

DISCUSSION

After analysing at the results, we remarked big differences between the data of the 2 World Championships either when consider for all routines (global) either by apparatus (Hoop, Ball, Clubs and Ribbons). The main change in the data from one Olympic Cycle to the other was register in the Apparatus Difficulty component. These differences was statistically significant.

Rhythmic Gymnastics has been experiencing a constant and outstanding technical evolution for the last decades because of the evolution of the Code of Points (Palomero, 1996; Liu & Kuang, 2001; Wang et al, 2013), meaning these results could be seen in two different ways.

In one hand the intention to improve/reinforce/develop the specifics of Rhythmic Gymnastics, which is characterized by the manipulation of handling apparatus (Bobo & Sierra, 2003), and, in the other hand, considering the great complexity of execution (Vitrichenko et al, 2011) which needs a great number of work hours (Lebre, 2011). We can also speculate that the final grade will allow a better identification of the gymnasts' position in the ranking (Leandro et al, 2017), given the fact that the gymnasts with lower ranking face greater difficulties to get better grades (in Masteries/ AD and DER), due to execution problems (Breitkreutz & Hökelmann, 2014).

The execution of the Apparatus Difficulties demands extraordinary coordination, (Sierra & Bobo, 2015). However, they are also those where the gymnasts can have more technical faults which cancel the value of the difficulty, especially in the weaker gymnasts (Leandro et al, 2016). The gymnasts with the intention of getting top scores should present routines with a high level of difficulty combined with good execution quality (Agopyan, 2014).

So, according to the bibliography available, we might be in the presence of an increase to the degree of execution complexity caused by the improvement of

the apparatus technique and also a possible technical restructuration of Rhythmic Gymnastics.

Besides these factors, is also relevant to know whether the factors related to the sport specificity as the structure/organization of the Code of Points, the evaluation criteria defined by the sports authorities has an influence (positive or/and negative) on the gymnasts final scores (Leandro et al, 2015).

We also analysed the value of each component of the technical work of apparatus, (Mastery/AD and DER) and remarked that there was a clear increase of the Mastery/AD value from the 2013WCh to the 2017WCh, with significant differences. These differences can be related to the updated CoP 2017 (FIG, 2017), that redefined the evaluation criteria and increased the value of these technical elements. Other cause for the results registered can also be related to the fact that the training and competition process is always searching for better results by the inclusion of more complex abilities (Massida, 2012; Leskošek, Čuk, & Bučar-Pajek, 2015).

When we analyse the contribution, in percentage, of the body and apparatus difficulty for the total difficulty value in the 2013WCh and the 2017WCh, we can see that, for the total difficulty value, the contribution is clearly more balanced between 2 components in the present Olympic cycle. This balance works mainly due to the increase of the Mastery/AD elements. According to (Bobo & Sierra, 2003), it is very important to allow a balanced appreciation of the different dimensions of the sport, in both aspects of quality or quantity in the performance of gymnasts.

Additional research in other competitions of the present cycle to confirm the consistency of the results, being even usual for the technical committee to readjust the COP after the 1st WCh of each cycle.

In conclusion, the results found with this study can help to understand the real effect in competition routines caused by the changes in the CoP. It can also help coaches to find strategies to improve the training process and foresee the path that follows the evolution of the sport, with more diverse and varied choreographies and compositions, given the fact that there's a greater balance in the use of different elements, giving privilege to the apparatus technique. Finally, the results we got show the possibility of a sports show with more intensity, variety and balance for the next Olympics Games in Tokyo 2020.

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