APPARATUS DIFFICULTY IN GROUPS ROUTINES OF ELITE RHYTHMIC GYMNASTICS AT THE PORTIMÃO 2009 WORLD CUP SERIES

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Original research article

Abstract

The aim of this study was to establish whether a pattern exists in the type of apparatus specific elements chosen by elite rhythmic gymnastics groups. Twenty six group exercise routines (5 hoops, and 3 ribbons and 2 ropes) performed by thirteen groups at the Portimão 2009 World Cup Series gymnastics competition were analysed. Results: (a) mastery and risk with throw: (i) all groups preferred using throws during a body flight; (ii) in the 3 ribbons and 2 ropes routines the use of catches during an element with rotation was most common, whilst in the 5 hoops routines catches without the help of the hands were used most frequently; (iii) compulsory rotations were the most commonly used elements in the 5 hoops routines, whereas the additional rotation was preferred in the 3 ribbons and 2 ropes routines. (b) mastery without throw: (i) rotations and handlings were the most frequently used elements in the 5 hoops routines whilst snakes & spirals were preferred in the 3 ribbons and 2 ropes routines; (ii) there were no records of risk without throw. (c) with regard to collaborations (COLL) the most frequently used were the COLL RR1 (these include a large throw with risk of loss of visual contact with the apparatus during its flight, as well as passing over, below or through one or several apparatus or other gymnasts during the flight of the apparatus) in the 5 hoops routines and the COLL with throw in the 3 ribbons and 2 ropes routines. This study demonstrates that it is possible to broadly identify and describe patterns of element use for each apparatus type for 5 hoops, and 3 ribbons and 2 ropes routines.

Keywords: *rhythmic gymnastics, group routines, apparatus difficulty score, evaluation, performance.*

INTRODUCTION

The first time rhythmic gymnastics (RG) groups participated in the Olympic Games was at the 1996 games in Atlanta. Since then, the standard of group performance has increasing improved. These improvements have always been ruled by the modifications in the FIG code of points. The performances in RG competitions are evaluated by a final score composed from 3 sub-scores: difficulty (which includes both body difficulty (D1) and apparatus difficulty (D2)), artistic, and execution.

The RG performance requirements of the FIG (International Gymnastics Federation) are closely linked to the code of points (CP). As the CP changes every Olympic cycle, so do the routine requirements, which become more demanding and increasingly difficult.

The increasing difficulty of RG competition exercises is what characterizes the development of RG (Lisitzkaya, 1995). In group exercises this author states that success is achieved when there is a high level of movement synchrony, proper distribution of movement in space, and a balanced conceptual and emotional

expression of the different group formations. The current trends in the composition of exercises are, according to Avilés (2001): a) an increase in the variety of both body and apparatus movements (this is determined by the search for new elements and combinations, as well as by the exploration of the movement in its totality); b) a search for originality; c) an increase in the quantity of complex elements (with increasing levels of difficulty associated with each Olympic cycle); d) a decrease in connecting moves with no technical difficulty or complexity; e) a high level of technical skill in handling the various apparatus together with a high percentage of efficacy in the execution of specific technical elements; f) the development of a strong identity, based on the individual or group characteristics; g) the careful selection of music taking into account the specific interpretation given by the gymnasts; h) an increase in the number of risk and outstanding elements in the composition of the exercises; and finally i) the increase in artistic value of the composition.

The main problem regarding the final score is concerned with the apparatus difficulty score (Lebre, 2007). The latest modifications to the CP state that apparatus difficulty is a crucial element in performance assessment, and so this element now has a greater impact on the final score.

The authors believe that the understanding of the demands posed by the RG CP and the observation of the performances of high level group competitions will give a new insight into RG and the strategies used in the composition of exercise routines in high level competitions. With this in mind, we analysed the composition forms submitted by the competing groups at the 2009 World Cup in Portimão (Portimão/09-WC), Portugal. The compulsory provision of competition forms containing a description of the difficulty of the exercises (introduced in FIG, 2001) has encouraged more rigorous scoring (Ávila, 2001).

The aim of this study is to identify patterns in the choice of apparatus specific elements in high level RG groups and therefore make an assessment of the apparatus difficulty (D2).

METHODS

Analysis of the apparatus specific elements included in the routines was carried out using competition forms that each group has to provide prior to the competition. We opted for the use of these forms instead of video recording, CD or .avi captures because by doing this we ensured that the analysis would not be affected by mistakes made during the group's performance in the competition. Firstly, we investigated the differences between the type of D2 difficulty categories used in the composition of the exercises (5 hoops, and 3 ribbons and 2 ropes). The classification used to organise the different D2 difficulty categories was the official classification used in the FIG Code of Points (FIG, 2009). Thus, the authors have divided the apparatus elements into three main categories: 1. *mastery and risk with throw*, 2. *mastery and risk without throw*, and 3. *collaborations amongst the gymnasts*. In addition to this we carried out further analysis into the use of various possible elements within each of these three categories in the composition of group exercises. Again, the authors used the classification as defined by the FIG/09 CP.

In order to determine the pattern of apparatus difficulty (D2) in RG group exercises, all exercise composition sheets for the RG groups were considered. Data on apparatus specific elements for the 26 group exercise routines for the 13 competition groups performing 5 hoops, and 3 ribbons and 2 ropes exercises were extracted and recorded in a Microsoft Excel spreadsheet. SPSS version 17.0 (Statistical Package for the Social Sciences Version 17.0, Chicago, USA) and Microsoft Excel were used to analyse the data. Significance level was set at $\alpha = 0.05$ (corresponding to a confidence level of 95%).

We used the mean as a measure of central tendency, and the standard deviation as a measure of the spread of the data. In order to make comparisons between the two types of competition exercises (5 hoops versus 3 ribbons and 2 ropes) a nonparametric test (Wilcoxon test) was applied to the data.

RESULTS

The different types of apparatus difficulty (D2) elements were classified according to FIG/09 CP.

The results are presented by D2 element (*mastery and risk with throw, mastery and risk without throw*, and *collaborations amongst the gymnasts*), and by exercise (using 5 identical apparatus – 5 hoops, or using a combination of two different apparatus – 3 ribbons and 2 ropes).

Apparatus Difficulties (D2)

The D2 elements in FIG/09 CP are composed of: (1) *mastery and risk with throw*, (2) *mastery and risk without throw* and (3) *collaborations among the gymnasts*.

Figure one shows the average use and standard deviation of D2 difficulties in both the 5 hoops and the 3 ribbons and 2 ropes routines. The statistical significance of the differences between the choice of D2 elements in the 5 hoops and the 3 ribbons and 2 ropes routines were assessed using Wilcoxon test and the results are displayed in table 1.

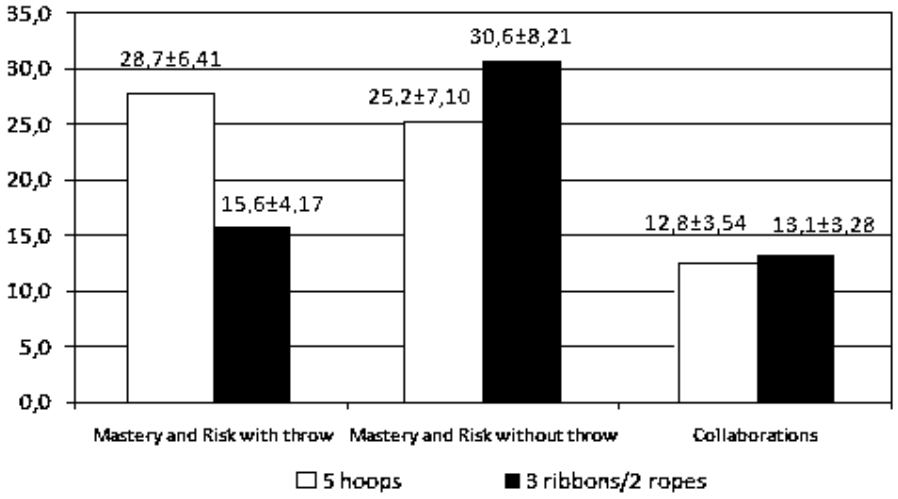

Figure 1. *Average use and Standard deviation of D2 difficulties in the 5 hoops, and 3 ribbons and 2 ropes routines at Portimão/09-WC*

Table 1. *Wilcoxon test results*

D2 (Apparatus difficulties)	Wilcoxon test (p)
Mastery and Risk with throw	0.001*
Mastery and Risk without throw	0.050
Collaborations	0.450

In the 3 ribbons and 2 ropes routines the preferred choice of D2 difficulty was the *mastery and risk without throw* (30.6 ± 8.21) (see figure 1). Nevertheless, there were no significant differences between the choice of this type of difficulty in the 3 ribbons and 2 ropes and the 5 hoops routines ($p = 0.05$) (see table 1). In the case of the 5 hoops routines the *mastery and risk with throw* were the most used D2 difficulty types (28.7 ± 6.41) (see figure 1). There were significant differences between the use of this kind of difficulty in the 3 ribbons and 2 ropes (used less frequently) and the 5 hoops routines ($p = 0.001$) (see table 1). The authors believe the differences in the use of *mastery and risk with throw* in the 3 ribbons and 2 ropes routines when compared to the 5 hoops routines are due to major differences in the demand/skill associated with the manipulation of deformable versus rigid apparatus. In one respect, deformable apparatus (as is the case of ribbons and ropes) are harder to manipulate than the hoops (rigid apparatus). Furthermore, the catches of such throws are also more difficult to execute with deformable apparatus because the apparatus must not lose its shape during the phase of flight and must not accidentally touch the ground when being caught. If any of the above situations occur, the gymnast's score will be penalized by the judges. In addition, the D2 judges may completely disregard the performance and therefore not take it into account for the final D2 score.

D2 difficulties were used least frequently in the *collaborations*, 12.8 ± 3.54 in 5 hoops routines and 13.1 ± 3.28 in 3 ribbons and 2 ropes routines. However, we must note that the use of D2 difficulties in *mastery and risk with throw* and *mastery and risk without throw* can be worth between 0.1 and 0.3 points, and its use in *collaborations* between 0.1 and 0.8 points. Thus, although the use of D2 difficulties is less frequent in *collaborations* it may still contribute to an increased final D2 score (apparatus difficulty).

Mastery and Risk with throw

The *mastery and risk with throw* includes different throw types, catches, and risk with throw.

Mastery with throw

The *mastery with throw* category includes different throw and catch types. Figure 2 displays the average use and standard deviation of the different throw types in both the 5 hoops, and the 3 ribbons and 2 ropes routines. Table 2 shows the results of the Wilcoxon test to establish whether there is a significant difference between the use of the various throw types in the 5 hoops and 3 ribbons and 2 ropes routines.

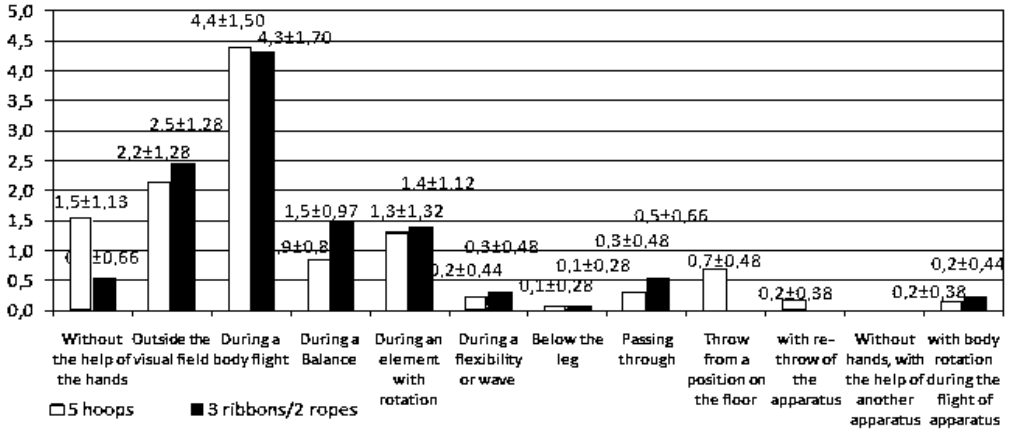

Figure 2. *Average use and Standard deviation of different throw types in the 5 hoops, and 3 ribbons and 2 ropes competition routines at the Portimão/09-WC*

Table 2. *Results of the Wilcoxon tests between the number of throws in 5 hoops, and 3 ribbons and 2 ropes competition routines present in the Portimão/09-WC (Significance level *p<0.05)*

Throw	Wilcoxon test (p)
Without the help of the hands	0.008*
Outside the visual field	0.465
During a body flight	0.805
During a Balance	0.057
During an element with rotation	0.791
During a flexibility or wave	0.564
Below the leg	1.000
Passing through	0.046*
Throw from a position on the floor	0.414
With re-throw of the apparatus	0.157
Without hands, with the help of another apparatus	1.000
With body rotation during the flight of apparatus	0.564

Figure 2 shows that in both types of routines *throws during a body flight* were most frequently used (4.4 ± 1.50 in 5 hoops routines and 4.3 ± 1.70 in 3 ribbons and 2 ropes routines). Furthermore, table two shows that there are no significant differences between the average use of this kind of throw in both types of routines (p = 0.805). This may be due to the fact that of all the different types of body difficulties (jumps, balances, pivots and flexibility/waves) jumps are most frequently used in the compositions of the groups routines in PWC 2009 (Avila-Carvalho et al., 2009c). We believe that the *throw during a body flight* is relatively easy to perform and may allow the performance of additional types of throws such as *outside the visual field*, *without the help of the hands*, and in this case the throw would be worth 0.3 instead of 0.1 points.

The second most common way to execute the throws in both routines were *outside visual field throws* (2.2 ± 1.28 in 5 hoops routines and 2.5 ± 1.28 in 3 ribbons and 2 ropes routines). Once again there were no significant differences between the average use of this kind of throw in the two types of exercise routine (p = 0.465) (see table 2). The throw types where statistically significant differences occurred between 5 hoops, and 3 ribbons and 2 ropes routines are as follows: (1) *throw without the help of the hands* (p = 0.008),which is a type of throw easily executable with the hoops as these do not loose shape during flight (unlike what happens with deformable apparatus such as ribbons and ropes) and hence is used more in the 5 hoops routines; (2) *passing through throw* which is more frequently used in the 3 ribbons and 2 ropes routines (p = 0.046) due to the dimension of the type of apparatus.

Figure 3 displays the average use and standard deviation of different catching types in the 5 hoops, and 3 ribbons and 2 ropes routines. Table 3 summarizes the statistical significance of the differences between average use of the various catches in the 5 hoops, and 3 ribbons and 2 ropes routines (again, assessed using a Wilcoxon test).

Looking at figure 3 we can conclude that during the 3 ribbons and 2 ropes routines the use of *catches during an element with rotation* was used most frequently (1.2 ± 1.30). Its use was significantly greater in the 3 ribbons and 2 ropes routines than the average use in the 5 hoops routines (p = 0.028) (see table 3). In the case of the 3 ribbons and 2 ropes routines we observed that the criteria *during an element with rotation* is usually associated with a body flight or performed *during a flexibility*, so it is a possible way to increase the D2 score because it adds 0.1 points to the initial score.

In the 5 hoops routines the use of *catches without the help of the hands* was used most frequently (2.3 ± 1.55). This kind of catch was not used in the 3 ribbons and 2 ropes routines and hence there is an obvious significant difference between the use of this type of catch in the two types of routines (see table 3, p = 0.003). This probably happens because the hoop *catches without the help of the hands* may be done in different ways that are not difficult to perform, such as *through catches between the legs*, *from a floor position,* or even *standing or catching it on the leg with hoop rotation*. Any of these situations would be worth 0.2 points without a great risk of loss of the apparatus. It is therefore not surprising that the 3 ribbons and 2 ropes routines did not make use of these types of catches as the catches of a deformable apparatus with the help of the hands would be difficult and risky. The apparatus catches must be executed without technical mistakes and this is monitored by Execution and D2 judges (FIG/09 CP).

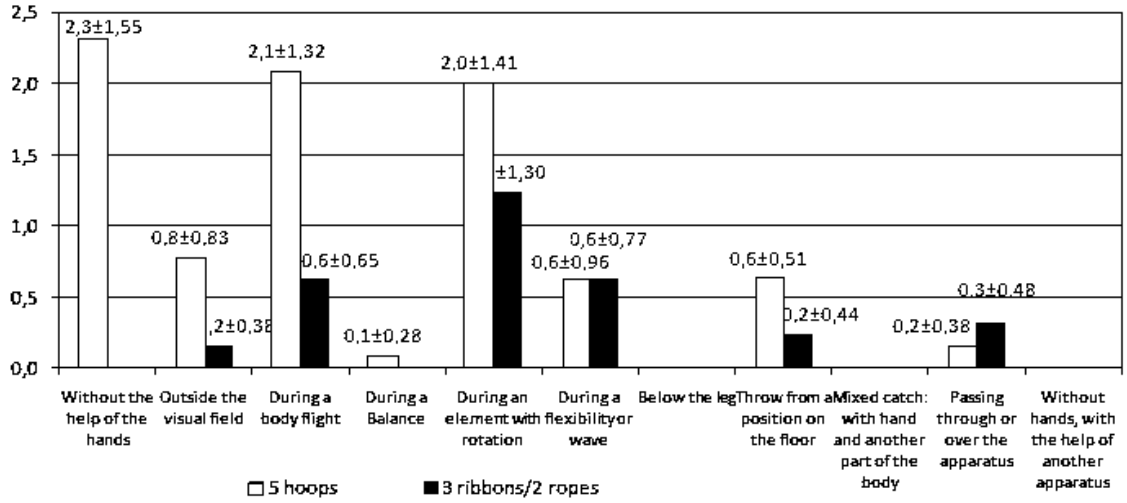

Figure 3. *Average use and standard deviation of the different catch types in 5 hoops, and 3 ribbons and 2 ropes routines performed at the Portimão/09-WC competition*

Table 3. *Results of Wilcoxon tests assessing the different types of catch used in 5 hoops, and 3 ribbons and 2 ropes competition routines at the Portimão/09-WC (Significance level *p<0.05)*

Catches	Wilcoxon test (p)
Without the help of the hands	0.003*
Outside the visual field	0.033*
During a body flight	0.006*
During a Balance	0.317
During an element with rotation	0.028*
During a flexibility or wave	0.931
Below the leg	1.000
Throw from a position on the floor	0.025*
Mixed catch: with hand and another part of the body	1.000
Passing through or over the apparatus	0.414
Without hands, with the help of another apparatus	0.157

Risk with throw

The risks with throw must comprise of at least the two following basic actions: (i) during the flight of the apparatus, a minimum of 1 element, with rotation of the body on the vertical or horizontal axis, with or without passing on the floor; (ii) during the catch of the throw, loss of visual contact with the apparatus during or immediately at the end of an element with body rotation on the horizontal axis (FIG/09 CP).

Figure four shows the average use and standard deviation of the number of body rotations in risks with throw in both type of group routines (5 hoops, and 3 ribbons and 2 ropes routines). Table four summarises the statistical significance of the differences between the average number of body rotations in risks with throw in 5 hoops, and 3 ribbons and 2 ropes routines (using a Wilcoxon test).

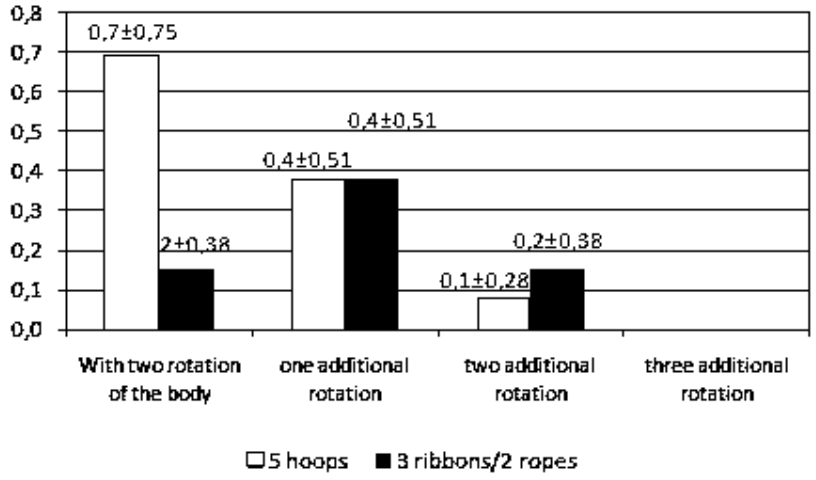

Figure 4. *Average use and standard deviation of number of body rotations in risks with throw in both type of group routines (5 hoops, and 3 ribbons and 2 ropes routines) performed at the Portimão/09-WC competition*

Table 4. *Results of the Wilcoxon tests to the mean use of number of body rotations in 5 hoops, and 3 ribbons and 2 ropes competition routines at the Portimão/09-WC (Significance level *p<0.05)*

Body rotation type	Wilcoxon test (p)
With two rotation of the body	0.038*
One additional rotation	1.000
Two additional rotations	0.564
Three additional rotations	1.000

From the observation of figure four we can see that in the 5 hoops routines the *compulsory rotations* (2 in total) in risk with throw (0.7 ± 0.75) were predominantly used. The use of such rotations was significantly higher (p = 0.038) than that in 3 ribbons and 2 ropes routines (see table 4). In the 3 ribbons and 2 ropes routines the more frequently used rotation type was the *one additional rotation* in risks with throw (0.4 ± 0.51). In this case the majority of the risks have been carried out with three body movements with rotations. The fact that the rope and ribbon are both lighter apparatus means that the respective flight times are a little longer and that allows the gymnasts

more time to perform extra body elements. Despite this there were no statistically significant differences in the use of these rotations between the two types of exercise routine.

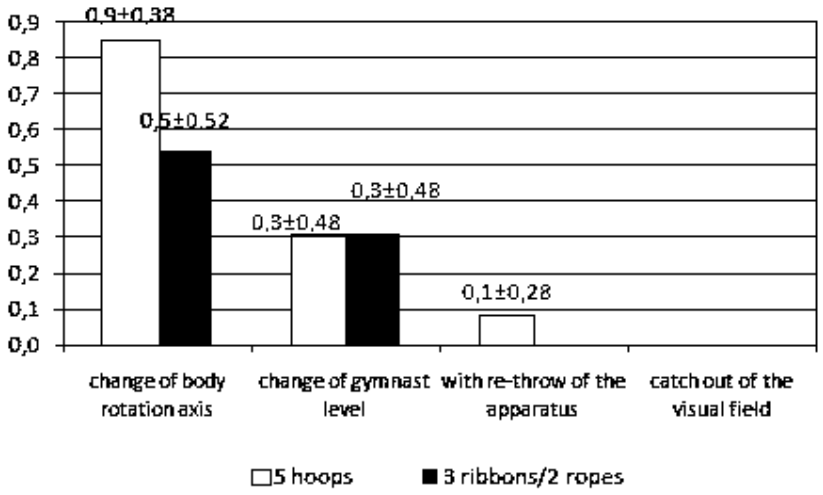

Figure 5. *Average use and standard deviation of additional criteria in risks with throw in both types of group routine (5 hoops, and 3 ribbons and 2 ropes routines) performed at the Portimão/09-WC competition*

Table 5. *Results of Wilcoxon tests between the average use of additional criteria in the 5 hoops, and 3 ribbons and 2 ropes competition routines at the Portimão/09-WC (Significance level *p<0.05)*

Additional criteria type	Wilcoxon test (p)
Change of body rotation axis	0.046*
Change of gymnast level	1.000
With re-throw of the apparatus	0.317
Catch out of the visual field	1.000

From figure five we can see that in the 3 ribbons and 2 ropes, and the 5 hoops routines the *change of body rotation axis* is the most frequently used criteria in both routines, with 0.9 ± 0.38 in 5 hoops routines and 0.5 ± 0.52 in 3 ribbons and 2 ropes routines, but with statistically significant differences between the two types of exercise routines (p = 0.046) (see table 5). When the gymnasts perform the first rotation on the vertical axis this corresponds to a bonus of 0.1 points in the final risk score, in our opinion a relatively simple way to increase the risk score.

Mastery and Risk without throw

The Mastery and Risk without throw includes: *mastery without throw* and *risk without throw*.

Mastery without throw

Figure six shows the average use and standard deviation of each individual mastery without throw categories in 5 hoops routines performed at the Portimão/09-WC. Table six shows the results of the application of Wilcoxon tests to the average use of the various *Mastery without throw* categories in 5 hoops routines.

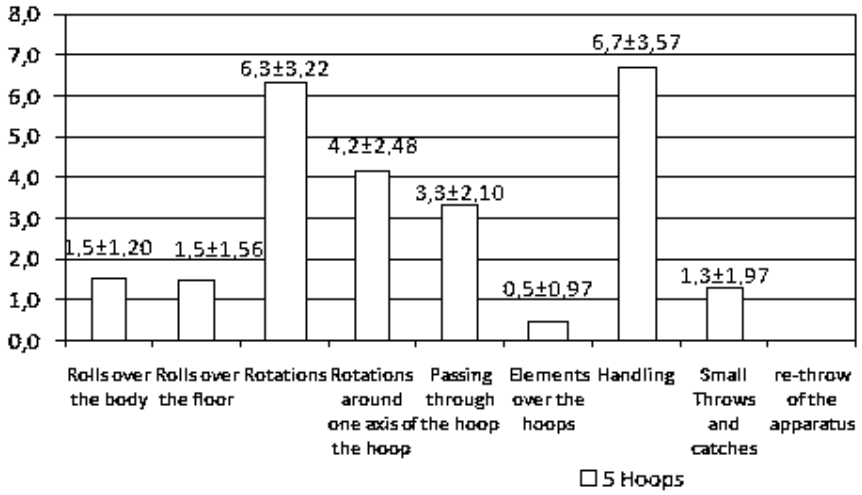

Figure 6. *Average use and standard deviation of each individual Mastery without throw category in the 5 hoops routines performed at the Portimão/09-WC.*

Table 6. *Results of the application of Wilcoxon tests to the average use of the various Mastery without throw categories in the 5 hoops routines performed at the Portimão/09-WC (Significance level *p<0.05)*

Mastery without throw - Hoops/Wilcoxon test (p)	ROF	ROT	RA	PT	O	H	STC	RT
Rolls over the body (ROB)	0.810	0.001*	0.008*	0.008*	0.046*	0.002*	0.680	0.003*
Rolls over the floor (ROF)		0.001*	0.008*	0.240	0.106	0.002*	0.918	0.011*
Rotations (ROT)			0.113	0.280	0.001*	0.554	0.003*	0.001*
Rotations around one axis of the hoop (RA)				0.501	0.002*	0.092	0.027*	0.001*
Passing through the hoop (PT)					0.004*	0.005*	0.020*	0.002*
Elements over the hoops (O)						0.001*	0.206	0.109
Handling (H)							0.001*	0.001*
Small Throws and catches (STC)								0.042*
Re-throw of the apparatus (RT)								

From figure six we can see that the *rotations* (6.3 ± 3.22) and the *handling elements* (6.7 ± 3.57) were the most frequently used types in the 5 hoops routines. The use of these two types of *mastery without throw* in the 5 hoops routines is significantly greater than that of all the remaining categories (see table six). The handlings were also the most performed apparatus elements in the hoops routines at the Portimão/08-WC (Ávila-Carvalho et al., 2009a).

The FIG/09 CP encourages the diversification of the apparatus mastery and states that the gymnasts have to achieve this during the performance of body difficulties. This is perhaps why in the Portimão/08-WC there was less variety in apparatus working (essentially composed of handlings in the 5 hoops routines performed). The *rotations* are a means of diversifying the work with the apparatus, though still technically relatively easy to use during the performance of body elements (Cardoso, 2009) and thus were quite commonly used in the compositions observed.

It is also a fact that no group in the World Cup at Portimão 2009 used a *re-throw of the apparatus* as a way of

introducing variation in the use of the apparatus.

Figure seven shows the average use and standard deviation of each individual *Mastery without throw* category in the 3 ribbons and 2 ropes routines performed at the Portimão/09-WC. Table seven shows the results of the application of Wilcoxon tests to the average use of the various *Mastery without throw* categories in the 3 ribbons and 2 ropes routines.

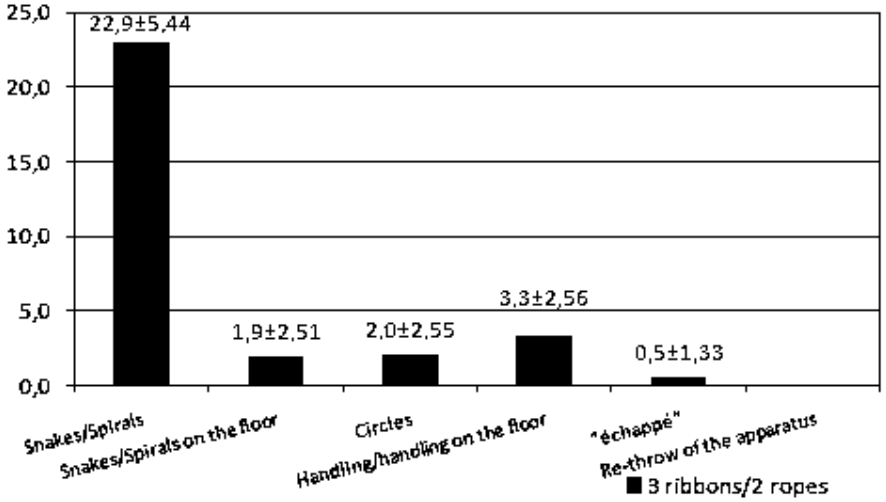

Figure 7. *Average use and standard deviation of each individual Mastery without throw category in 3 ribbons and 2 ropes routines performed at the Portimão/09-WC*

Table 7. *Results of the application of Wilcoxon tests to the average use of the various Mastery without throw categories in 3 ribbons and 2 ropes routines performed at the Portimão/09-WC (Significance level *p<0.05)*

Mastery without throw - ribbons/Wilcoxon test (p)	SF	CI	H	E	RT
Snakes/Spirals (S)	0.001*	0.001*	0.001*	0.001*	0.001*
Snakes/Spirals on the floor (SF)		0.858	0.154	0.090	0.027*
Circles (CI)			0.140	0.049*	0.011*
Handling/handling on the floor (H)				0.005*	0.005*
"Échappé" (E)					0.180
Re-throw of the apparatus (RT)					

From the analysis of figure seven we can observe that the *snakes/spirals* were the most frequently used apparatus element in the 3 ribbons and 2 ropes routines (22.9 ± 5.44). The use of this type of *mastery without throw* in the 3 ribbons and 2 ropes routines is significantly greater to that of all the remaining categories (see table seven).

The FIG/09 CP states that in order to contribute to the difficulty score, body difficulties must be executed simultaneously with apparatus mastery elements. The *snakes/spirals* are the easiest way to achieve this in 3 ribbons and 2 ropes routines (particularly due to the nature of one of the apparatus involved; the ribbons). We believe, therefore, that this is the reason why these elements are preferred, and hence the lack of diversity observed in the choice of the different types of element in this category despite the FIG/09 CP encouraging diversification.

Risk without throw

According to FIG/09 CP the *risk without throw* always includes a rolling of the apparatus on the body during a body rotation around the horizontal axis, with loss of visual contact with the apparatus.

The value of the risk may increase as follows: with passing on the floor during a body rotation; with re-throw/push-back of the apparatus, and with criteria associated with mastery without throw. There were no records of any risk without throw in both routines (5 hoops, and 3 ribbons and 2 ropes routines).

In the 3 ribbons and 2 ropes routines this is more obviously the case because, as we mentioned, the risk without throw always includes a rolling of the apparatus on the body, and this is not possible to execute with either ribbons or ropes. In the case of the 5 hoops routines we believe that this is a more difficult element (due to the high probability of dropping the apparatus) when compared to the risk with throw; and both generate the same amount of points.

Collaborations

The use of collaboration elements is summarised in figure eight. The categories considered are in accordance with the FIG/09 CP.

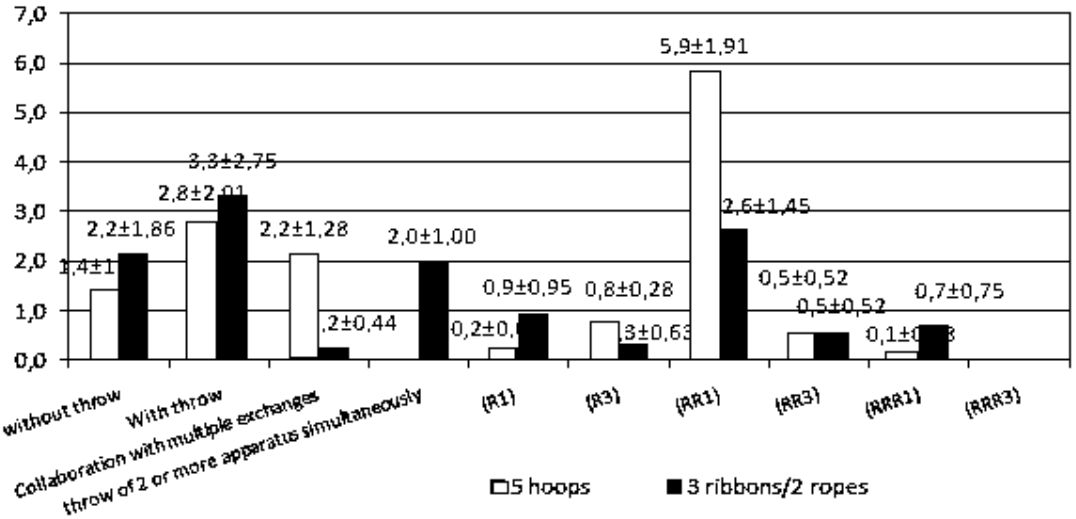

Figure 8. *Average use and standard deviation of the collaboration types in 5 hoops, and 3 ribbons and 2 ropes routines performed at the Portimão/09-WC*

Table 8. *Results of the Wilcoxon tests between the average use of the various collaboration types in 5 hoops, and 3 ribbons and 2 ropes routines performed at the Portimão/09-WC. (Significance level *p<0.05)*

Collaborations	Wilcoxon test (p)
Without throw	0.282
With throw	0.444
Collaboration with multiple exchanges	0.083
Throw of 2 or more apparatus simultaneously	0.889
(R1)	0.047*
(R3)	0.257
(RR1)	0.001*
(RR3)	1.000
(RRR1)	0.033*
(RRR3)	1.000

From figure 8 we can see that the preferred collaborations were the *collaborations RR1* in the 5 hoops routines (5.9 ± 1.91). *Collaborations RR1* include a long throw (double the height of the gymnast), a risk associated with the loss of visual contact with the apparatus during its flight, and passing above, below or through one or several apparatus or other gymnasts during the flight of the apparatus). These collaborations were used significantly more during the 5 hoops routines than in the 3 ribbons and 2 ropes routines (p = 0.001) (see table 8). The *collaborations with throw* was the most frequently used in the 3 ribbons and 2 ropes routines (3.3 ± 2.75). There were no statistically significant differences in the use of this type of collaboration between the two types of exercise routine (p = 0.444) (see table 8). The *collaborations with throw* add 0.2 points and the *RR1* add 0.5 points to the final score. This shows that coaches have a tendency to choose collaborations that are higher in risk, therefore generating higher scores in the 5 hoops routines.

We did not record any *collaboration RRR3* in either the 5 hoops or in the 3 ribbons and 2 ropes exercise routines. *Collaborations RRR3* include a throw with risk of loss of visual contact with the apparatus during its flight and passing through the apparatus, in flight, whilst the apparatus is neither being held by another gymnast nor by the gymnast passing through.

According to Ávila-Carvalho et al. (2009b) there was also no record of this kind of collaboration at the Portimão/08-WC. However at the Portimão/07-WC there were two groups that performed this kind of collaboration (Brazil and Venezuela).

CONCLUSIONS

In light of the results obtained in this study we can conclude that:

For *mastery and risk with throw* the groups preferred the higher score associated with using *throws during a body flight* for both types of apparatus. (a) In 3 ribbons and 2 ropes routines catches *during an element with rotation* were most frequently used (the application of the Wilcoxon tests demonstrated that there is a statistically significant difference in the average use of this type of difficulty between the two types of exercise routine).In the 5 hoops routines the use of *catches without the help of the hands* was most common, again with statistically significant differences in the average difficulty use between both types of exercise routines. Regarding *risks with throw* in 5 hoops routines the *compulsory rotations* (2 in total) were used most often, though this was not the case in the 3 ribbons and 2 ropes routines where the preferred element was *one additional rotation* in risks with throw (3 in total). Furthermore in risk with throw in 3 ribbons and 2 ropes and 5 hoops routines the *change of body rotation axis* was the most commonly used element

in both routines, despite the fact that there are statistically significant differences in the use of this element between the two types of exercise routine.

For *mastery and risk without throw* the *rotations* and the *handling elements* were the most frequently used apparatus elements in the 5 hoops routine. The use of these types of elements in the 5 hoops routines was significantly greater than the remaining types within this category. In the 3 ribbons and 2 ropes routines the *snakes/spirals* were the most frequently used elements. Again, the use of this type of element in the 3 ribbons and 2 ropes routines was significantly greater than the remaining types within this category. There was no record of any risk without throw in the 5 hoops, and the 3 ribbons and 2 ropes routines.

Finally, the most frequently used *collaborations* were: (a) the *collaborations RR1* in the 5 hoops routines (its use being significantly greater when compared to the use in the 3 ribbons and 2 ropes routines) and (b) the *collaborations with throw* in the 3 ribbons and 2 ropes routines.

In general terms we can say that there is a broad trend for each kind of apparatus, but this trend is not the same for the two types of exercise within the same group.

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