Comparative analysis of high-difficulty exercises with clubs in rhythmic gymnasts

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Abstract
This article examines the results of a pedagogical analysis of competitive routines with clubs, and in particular, elements of varying technical difficulty ("body difficulty," "apparatus difficulty") in highly skilled gymnasts. The technical features of their execution and their distribution within the competitive routines of the World Cup series finalists are identified. Attention is focused on their role and significance in the construction of competitive compositions and their evaluated worth according to experts.
Keywords: rhythmic gymnastics, "apparatus difficulty" elements, "body difficulty" elements, exercise with clubs, comparative analysis, technical mastery.

Introduction

Rhythmic gymnastics is one of the most aesthetically complex and technically demanding sports, requiring athletes to demonstrate a high level of coordination, flexibility, balance, artistry, and apparatus mastery. In recent years, the continuous development of the International Gymnastics Federation (FIG) Code of Points has significantly increased the importance of apparatus difficulty elements in competitive routines. Among various apparatuses used in rhythmic gymnastics, clubs are considered one of the most technically challenging due to the complexity of coordinated movements, asymmetrical actions, throws, catches, mills, and dynamic combinations performed at high speed.

Modern competitive practice shows that gymnasts increasingly include high-difficulty club elements in their routines to improve competitive scores and meet international standards. The execution quality of these elements directly influences the final performance score, especially in elite-level competitions. Therefore, the analysis of high-difficulty exercises with clubs has become an актуal scientific and methodological issue in rhythmic gymnastics training theory and practice.

A comparative analysis of competitive compositions allows researchers and coaches to identify the most frequently used high-difficulty elements, evaluate trends in apparatus handling techniques, and determine the effectiveness of different technical approaches used by gymnasts from various countries. Such analysis also contributes to the improvement of training methodologies aimed at developing technical mastery and increasing the reliability of performing difficult apparatus elements under competitive conditions.

Furthermore, studying the structure and dynamics of club difficulty elements helps optimize the preparation process of young and elite gymnasts, ensuring a more effective transition to the requirements of the new FIG rules. In this regard, the present study is devoted to a comparative analysis of high-difficulty exercises with clubs in rhythmic gymnasts, focusing on the content, frequency, and technical characteristics of complex apparatus elements performed in modern competitive routines.

According to L.A. Karpenko [1], M.O. Misnikova [2], I.S. Semibratova, M.S. Egorova [4], and R.N. Terekhina [9], one of the main trends in the development of modern rhythmic gymnastics involves issues related to the increasing complexity of apparatus handling techniques. This is reflected in the inclusion of a large number of original, technically complex, and high-risk elements in the training process.

In each Olympic cycle, the requirements for the content of athletes' competitive programs undergo changes due to adjustments in international competition rules. Thus, in the new Olympic cycle, special emphasis is placed on artistry, with added importance given to dance steps, embodiment of character, and musicality, which significantly changes the developmental direction of rhythmic gymnastics [6.7].

The addition of new mastery criteria to the competition rules in 2023 has made it possible to construct and include a greater number of original, high-value movements in compositions, but has also imposed higher demands on the development of spatial orientation, balance, apparatus handling, and coordination abilities.

In particular, this affects exercises with

Table 1. Number of apparatus difficulty elements in the clubs routine for gymnasts (2023,

No.	Gymnast's Name	One-handed throws	Rolls	Taps	Mills	Work without hand help	Work without visual control	Asymmetricalmove-ment	Throw of two clubs
1	Varfolomeev D. (Germany)	4	-	1	5	1	7	4	8
2	Fanni P. (Hungary)	3	-	1	5	1	12	6	7
3	Magdalina M. (Bulgaria)	5	1	2	4	1	16	5	10
4	Ikromova T. (Uzbekistan)	1	-	1	3	-	10	10	9
5	Taniyeva E. (Kazakhstan)	4	1	2	1	2	7	9	7
6	Raffaeli S. (Italy)	4	-	2	2	2	11	7	12
7	Kolosov M. (Germany)	1	1	2	3	2	4	8	10

clubs, which are distinguished from other all-around events by their dynamism, variety of movements, manipulation of two apparatuses, and extensive use of specific elements such as juggling, mills, and asymmetrical movements. These exercises require quick reactions, concentration, precise hand coordination, joint mobility, accuracy, and rhythm [3, 5, 10].

Objective of the study: to determine the technical complexity of "Apparatus Difficulty" and "Body Difficulty" elements in the individual club exercises of elite gymnasts.

Methods

Theoretical analysis and synthesis of literature, pedagogical observations, video analysis, and methods of mathematical statistics.

We analyzed the content of the clubs routines performed by the world's leading gymnasts during the final competitions of the Rhythmic Gymnastics World Cup series held in Tashkent and Baku in 2023 and 2026.

An analysis of the competitive clubs routines showed that the main fundamental move-

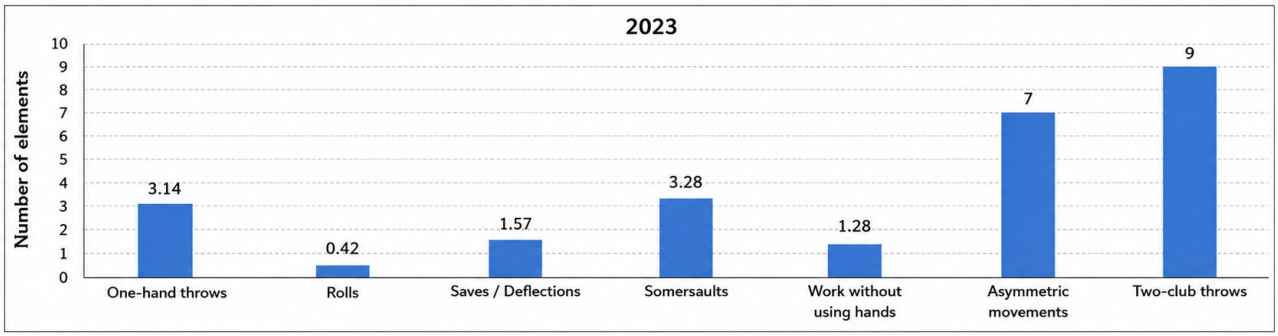


Fig. 1. Number of "apparatus difficulty" elements in the clubs routine (Tashkent)

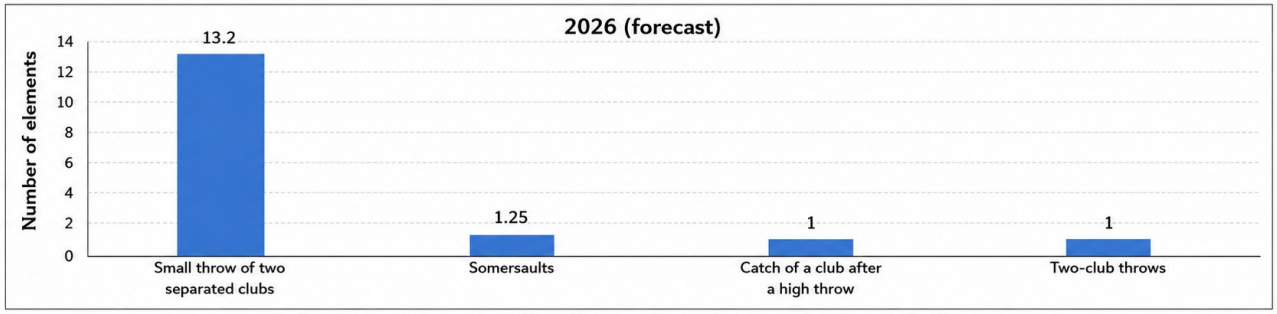


Fig. 2. Number of "apparatus difficulty" elements in the clubs routine (forecast for 2026, Tashkent)

Table 2. Number of apparatus difficulty elements in the clubs routine for gymnasts (*2026, Tashkent*)

	Gymnast's Name	Small throw of two separate clubs/ catch	Mills	Small throw of two connected clubs	Catching a club after a high throw	Throws with two clubs
1	*Varfolomeev D. (Germany)*	14	1	-	-	-
2	*Harnasko A. (Belarus)*	15	-	-	-	-
3	*Ikromova T. (Uzbekistan)*	12	2	-	-	-
4	*Nikolova S. (Bulgaria)*	15	-	-	-	-
5	*Dragas T. (Bulgaria)*	12	1	-	1	1
6	*Atamanov A. (Israel)*	14	-	-	-	-
7	*Onofriichuk T. (Ukraine)*	13	1	-	-	-
8.	*Ilteryakova S. (Russia)*	15	-	-	-	-

ments in this apparatus event are: ways of holding the apparatus, rotations, throws, and catches. Due to the open-ended scoring for difficulty, there is a trend toward modifying competitive programs, specifically in apparatus handling. Consequently, the number of Apparatus Difficulty (AD) elements in competitive routines has gradually decreased. For instance, while the maximum number of ADs averaged 28 in 2021, by 2025-2026 it had dropped to 15.

Results and discussion

When examining the types of apparatus movements that gymnasts most frequently used while performing clubs routines in 2023 and 2026, a downward trend can be noted in the number of Apparatus Difficulties based on the "mill" (averaging up to two times per routine). This can be attributed to the difficulty of combining this movement with various criteria, an insufficient technical foundation, and its low value of 0.3 points (Fig. 1, 2).

In 2023, the majority of the competitive clubs routine consisted of fundamental technical movements such as "mills," small club circles, asymmetrical movements, and small circles with both clubs, and the greatest variety in apparatus handling was noted (Table 1).

In the next Olympic cycle, 2025-2028, there is a noted significant increase in such types of handling as small throw/catch, high throw, and catch from a high throw, which will constitute up to 90% of all DA, while club taps

Table 3. Number of Apparatus Difficulty elements in gymnasts' competitive clubs routines (2026, Baku)

N	Gymnast's Name	Small throw of two separate clubs/ catch ⇒	Mills ×	Small throw of two connected clubs ⟷	Catching a club after a high throw ↓	Throws with two clubs ⇗
1	Varfolomeev D. (Germany)	14	1	-	-	-
2	Harnasko A. (Belarus)	15	-	-	-	-
3	Ikromova T. (Uzbekistan)	12	2	-	-	-
4	Nikolova S. (Bulgaria)	15	-	-	-	-
5	Dragas T. (Bulgaria)	12	1	-	1	1
6	Atamanov A. (Israel)	14	-	-	-	-
7	Onofriichuk T. (Ukraine)	13	1	-	-	-
8.	Ilteryakova S. (Russia)	15	-	-	-	-

Table 4. Difficulty Components of the Competitive Clubs Routine for Top Gymnasts (Baku)

No.	Surname First Name	Body Difficulty DB				Apparatus Difficulty DA	DB+DA
		⋀	⊤	⚲	R		
1.	Varfolomeev, D.	1.2	0.6 0.6 0.6	1.0 0.9 1.2	0.8 0.8 0.7 0.9	14 x 0.3	
			9.3			4.2	13.5
		⋀	⊤	⚲	R		
2.	Ikromova, T.	1.8	0.6 0.6	1.7 0.6 0.6	0.6 0.5 0 0	14 x 0.3	
			7.0			4.2	11.2

and rolls were not performed by gymnasts at all (Tables 2, 3).

As noted by R.N. Terekhina and A.S. Malneva [8], the "Difficulty" score is a significant factor in the final result for a performance, as the scale for this component of performance skill in the competition rules is open-ended.

In this regard, world-class gymnasts who have achieved a high level of mastery perform elements of increased difficulty, valued at 0.3 points and higher, by combining complex apparatus work with various difficulty criteria: without visual control, without help from the hands, and on the catch from a high throw. Judges also evaluate Apparatus "Difficulty" elements performed during Body "Difficulty" elements, for example, a "mill" during a "penché" balance, among others.

Our analysis of the clubs routine composition, specifically the number of elements that make up the "difficulty" score (DB + DA), is presented. An expert evaluation of the routines of the two top gymnasts showed that over two Olympic cycles, World and Olympic champion D. Varfolomeev has demonstrated a high level of consistency in all major competitions. Her clubs routine is characterized by the virtuoso execution of complex elements, a perfect combination of music with body movement, and apparatus handling. All Body Difficulty elements were performed in combination with Risk elements valued from 0.7 to 0.9 points.

Gymnast T. Ikromova successfully demonstrated various jumps, pivots, and Masteries. However, the difficulty of her "Risk" elements was lower, at 0.5-0.6 points (Table 4).

Conclusion

Thus, despite the increased coordinative complexity of the gymnast's interaction with the apparatus and the widespread use of club-specific manipulations such as "mills," asymmetrical movements, and cascading throws, athletes during competitive performances use a monotonous and repetitive set of additional criteria to assess apparatus difficulty, which diminishes the overall impression.

Achieving high athletic mastery and competitiveness in the international arena is determined not only by a set of technically complex elements but also by their artistic execution, which expresses the unique style of each gymnast in accordance with the competition rules.

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